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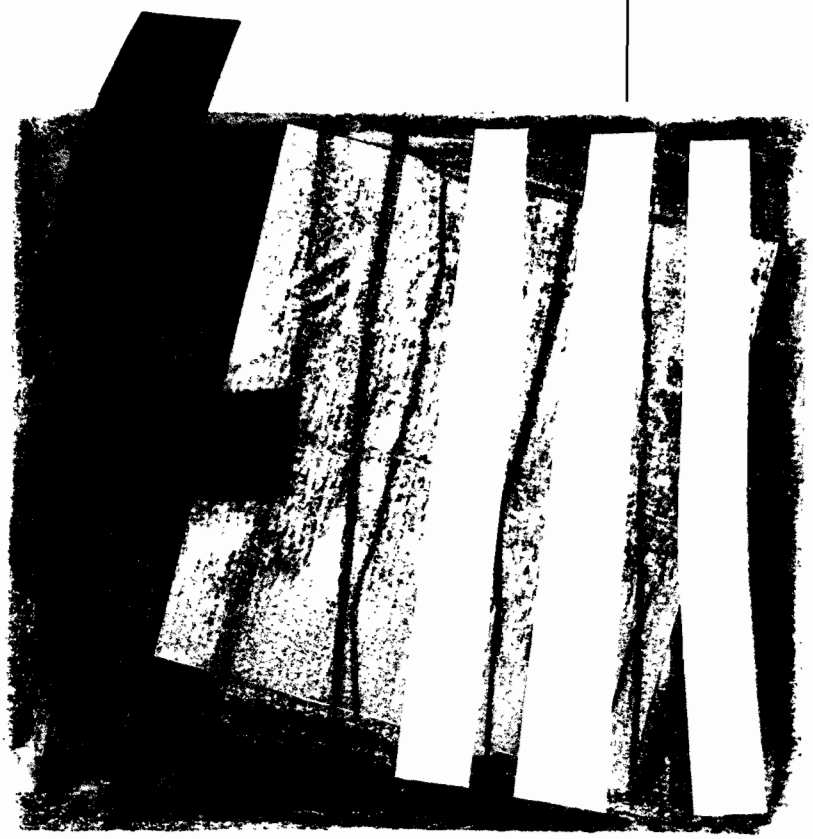

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GENDER SEGREGATION: FROM BIRTH TO OCCUPATION *

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Abstract

Most of the existing literature studies the gender segregation induced by occupational choices in the employed population. This paper also studies the segregation induced by age/education characteristics and labor market participation decisions in the population consisting of non-students of working age. The gender segregation index used, related to the entropy notion in information theory, is additively decomposable for any partition and it has a commutability property. The empirical part uses Labor Force Survey data for Spain for 1977 and 1992. In both years, most of the gender segregation takes place within, rather than between age/education subgroups. In 1977 labor market participation decisions account for 67.6 per cent of overall gender segregation. During the 1977-1993 period, most of the 27 per cent reduction in overall gender segregation can be attributed to labor market participation changes, while gender segregation induced by occupational choices remains essentially stable.

Keywords: gender segregation; additively decomposable entropy indexes; labor market participation decisions; occupational choices; age/education characteristics.

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I. INTRODUCTION

Gender segregation in the labor market is an important aspect of the way this market works. We can think of gender patterns in labor market outcomes as the result of voluntary choices which reflect differences in individual preferences, as well as technological constraints that favor some gender skills over others in certain economic activities. But gender segregation may also be a mechanism for social enforcement of wage and other forms of gender discrimination. Thus, measuring the extent of this phenomenon and its evolution over time in specific countries is an interesting topic from the point of view of both positive and normative economics.

All previous studies on gender segregation have concentrated on measuring this phenomenon among the employed population. In a few instances, some authors have classified all existing jobs according to two dimensions in order to study different structural aspects of gender segregation in a given moment of time[(1)]. More often, gender segregation has been studied along a single dimension, usually, occupation. When this is the case, the core of the study is the evolution of gender segregation over time[(2)].

Presumably, the distribution of people across occupations (and/or industries) is the result of the demand for and the supply of labor. But the interplay between the forces of demand and supply at this stage, is conditional on the labor market participation and the human capital investment decisions previously made by both genders. The first contribution of this paper is to extend the domain of previous studies by considering, not only the gender segregation of

the employed population, but the gender segregation of the entire non-student population of legal working age.

For this purpose, a framework is presented in which the overall gender segregation at a given moment in time is accounted for by three factors: (i) the productive characteristics of the labor force for which information is readily available, namely, the age and the educational level attained by each individual; (ii) labor market participation decisions; and (iii) the usual classification of the employed population according to occupational choices. This is accomplished using the gender segregation index presented in Mora and Ruiz-Castillo (2000), an additively decomposable index which is based on the entropy concept used in information theory. The overall gender segregation at a moment in time is decomposed into four terms, induced by (i) labor market participation decisions within the non-student population of working age; (ii) occupational choices within the employed population; (iii) age/education characteristics within each of the occupations, and (iv) age/education characteristics within each of the remaining labor market situations, namely, the unemployed and those out of the active population.

The second contribution of the paper is to investigate the gender segregation across population subgroups in order to isolate the contribution to the overall gender segregation which can be attributed to each labor market category or age/education characteristic. Finally, the index's structure facilitates the decomposition of the intertemporal change in gender segregation into two terms which capture, respectively, changes in the relative demographic importance of the different population subgroups, and changes in their gender composition

which give rise to different gender segregation index values.

The interest of this approach is illustrated with an empirical application using Labor Force Survey data for Spain for 1977 and 1992. Among our main results, we summarize here the following four. (1) As in other Southern European countries, the household division of labor in Spain reflects traditional gender patterns: in 1977 two thirds of Spanish women are devoted to housework, while 80 per cent of males are in the active population. These gender differences in labor market participation decisions account for 67.6 per cent of overall gender segregation in that year. (2) During the 1977-1992 period, there is a reduction in overall gender segregation of 13.8 index points, or 27 per cent of the 1977 level. Most of this change, which proceeds independently of the business cycle, can be attributed to differential labor market participation changes by gender. (3) The gender segregation induced by occupational choices in the employed population slightly decreases. As a result, in 1992 the percentage of overall segregation accounted for by labor market participation decisions, occupational choices and age/education characteristics is 62.8, 32.0, and 5.2 per cent, respectively. (4) In both years, most of the gender segregation in Spain takes place within, rather than between age/education subgroups. However, we find interesting differences in the gender segregation induced by labor market participation and occupational choices across age/education subgroups.

The rest of the paper contains five Sections and two Appendixes. Section II is devoted to the measurement of segregation. Section III contains the empirical results for the non-student population of working age in 1977, and Section IV deals with the evolution of gender segregation in this population during the 1977-1992

period. Section V presents an alternative analysis focusing on the partition by age/education characteristics, while Section VI offers some concluding remarks. The measurement of gender segregation in our case, as well as the description of the data, are contained in Appendix I. The description of the 29 occupational categories selected in Mora and Ruiz-Castillo (2000), which are also used in this paper is contained in Appendix II.

II. THE MEASUREMENT OF SEGREGATION

There are two mayor differences between this paper and the previous literature on gender segregation. In the first place, that literature exclusively studies the employed population, while this paper studies the non-student population of working age, or "the population" for short. In the second place, most of the previous literature involves a single variable, say the occupational (or the industrial) choice of employed individuals, while we study three classification variables.

These differences in aims dictate some differences in measurement instruments which will be developed in this Section. We proceed in three steps, the first two of which refer to the gender segregation of the employed population. In the first step individuals are classified in terms of a single variable, say occupations. In the second step, individuals are classified in terms of occupations and a second variable, say age/education characteristics. Finally, the entire population is classified according to two the age/education characteristics and the labor market status, while the employed population is classified according to occupational choices and age/education characteristics.

II. 1. The Case of a Single Classification Variable

Let the employed population be classified according to occupations, indexed by $j = 1,\ldots, J$. Let F_j and T_j be the number of females and people of both genders, respectively, in occupation j, and let $F = \Sigma_j F_j$ and $T = \Sigma_j T_j$ be the total number of women and people in the employed population, respectively. Let $W_j = F_j/T_j$ and $W = F/T$ be the proportion of females in occupation j and in the employed population, respectively. In this paper, we say that there is gender segregation in occupation j whenever W_j differs from W. Following up on the ideas first introduced by Theil and Finizza (1971) and Fuchs (1975) in racial and gender segregation, respectively, gender segregation in occupation j is measured as the expected information of the message that transforms the proportions (W, (1 – W)) into the proportions $(W_j, (1 - W_j))$, i.e.:

$$I^j = W_j \log (W_j/W) + (1 - W_j) \log ((1 - W_j)/(1 - W)). \qquad (1)$$

The value of this expected information is zero when the two sets of proportions are identical; it takes larger and larger positive values when the two sets are more different. Thus, for example, when the employed population is predominantly male (female) and W is small (large), the presence of a female (or a male) occupation j ($W_j = 1$, or $W_j = 0$) implies a large value of I^j in expression (1), equal to $\log(1/W_j)$ (or to $\log (1/(1 - W_j)$, respectively). This is intuitively reasonable for a measure of gender segregation in each occupation.

The weighted average of such gender segregation indexes, with weights equal to the demographic importance of each subgroup in the employed

population, provides an adequate measure of gender segregation for the entire population. Thus, we define:

$$I = \Sigma_j (T_j/T)\, I^j. \qquad (2)$$

II. 2. The Case of Two Classification Variables

Let the employed population be classified in terms of both occupations and age/education characteristics, indexed by i = 1,...,I. Let F_{ij} and T_{ij} be the number of females and people of both genders, respectively, with age/education characteristics i employed in occupation j. Let $F_i = \Sigma_j F_{ij}$ and $T_i = \Sigma_j T_{ij}$ be the number of females and people in subgroup i, and let $w_{ij} = F_{ij}/T_{ij}$ and $W_i = F_i/T_i$ be the proportion of females with age/education characteristics i employed in occupation j, and in subgroup i, respectively. The expected information of the message that transforms the proportions (W, (1 – W)) directly into the proportions (w_{ij}, (1 - w_{ij})) is equal to:

$$I^{ij} = w_{ij} \log (w_{ij}/W) + (1 - w_{ij}) \log ((1 - w_{ij})/(1 - W)).$$

The index I^{ij} provides what we call a *direct* measure of gender segregation for the (i, j) subgroup in the double partition by age/education characteristics and occupations. Naturally, the greater the discrepancy between the proportion of females with age/education characteristics i and occupation j, w_{ij}, and the proportion of females in the employed population, W, the greater the segregation index I^{ij}. The weighted average of the I^{ij}s with demographic weights provides a reasonable overall measure of gender segregation:

$$\hat{I} = \Sigma_i \Sigma_j (T_{ij}/T)\, I^{ij}.$$

There are a number of procedures for measuring segregation along a single dimension[3], but not all of them are equally well-suited when one wants to consider two classification variables. In what follows, two decompositions of the overall index $\hat{I}$ into a between-group and a within-group term are presented –for proofs and further details, see Mora and Ruiz-Castillo (2000).

We say that the population in occupation j is segregated according to age/education characteristic i whenever w_{ij} differs from W_j. The corresponding gender segregation index is defined as $I_{ji} = w_{ij} \log (w_{ij}/W_j) + (1 - w_{ij}) \log ((1 - w_{ij})/(1 - W_j))$. The weighted average over all the age/education values is the index $I_j = \Sigma_i (T_{ij}/T_j) I_{ji}$, which measures the gender segregation induced by age/educational characteristics in occupation j. Finally, the within-group term is defined as $\hat{I}^{Wi}_{(j)} = \Sigma_i (T_j/T) I_j$. It can be shown that the overall index of gender segregation for the employed population $\hat{I}$ can be decomposed into two terms: a between-group term, $\hat{I}^{B}_{(j)}$, which is given by expression (2), and captures the direct segregation induced by occupational choices in the employed population; and the within-group term, $\hat{I}^{Wi}_{(j)}$.

Furthermore, the overall index $\hat{I}$ has a very convenient commutative property according to which it can also be decomposed into a between-group term which measures the direct gender segregation induced by age/education characteristics, $\hat{I}^{B}_{(i)} = \Sigma_i (T_i/T) I^i$, where $I^i = W_i \log (W_i/W) + (1 - W_i) \log ((1 - W_i)/(1 - W))$; and a within-group term which measures the gender segregation

induced by occupational choices within each age/education characteristic, $\hat{I}^{Wj}_{(i)} = \Sigma_j (T_{ij}/T_i) I_{ij}$, where $I_{ij} = w_{ij} \log (w_{ij}/W_i) + (1 - w_{ij}) \log ((1 - w_{ij})/(1 - W_i))$. Therefore, we have that

$$\hat{I} = \hat{I}^{B}_{(j)} + \hat{I}^{Wi}_{(j)} = \hat{I}^{B}_{(i)} + \hat{I}^{Wj}_{(i)}. \quad (3)$$

Thus, given two classification characteristics, the overall segregation index admits two alternative decompositions. In the first one, the term $\hat{I}^{Wi}_{(j)}$ informs us of the contribution of age/education characteristics to the overall gender segregation, the impact of occupations being kept constant in $\hat{I}^{B}_{(j)}$. Similarly, the term $\hat{I}^{Wj}_{(i)}$ measures the role of occupational choices on gender segregation, the impact of age/educational characteristics being kept constant in $\hat{I}^{B}_{(i)}$ [4].

II. 3. The Case of Three Classification Variables

During the life-cycle, individuals take a number of decisions whose implications for gender segregation are the topic of this paper. Essentially while young, people make their investment in human capital through formal education. Later on, if they become employed, they can acquire on-the-job training and work experience which will help characterize them as productive workers. Whatever their productive characteristics, members of the working age population who are not full-time students must decide whether to become part of the active or the inactive population. Finally, those who become employed must accept a job offer in a specific occupation.

At every stage along this process –when making the decision to invest in human capital, to participate or not in the labor market, or to work in a given

occupation- individuals might suffer subtle or open gender discrimination. The combined effect of individual preferences, technological restrictions and gender discrimination along these dimensions, produces a certain degree of gender segregation whose measurement constitutes the main aim of this paper. To understand the nature of our measurement strategy using cross-section data, notice that, at any point in time, any member of the population:

• has certain personal characteristics which determine her/his productive capacities; among them, the age and the educational level attained are readily observable;

• is in a certain relationship with the economic activity, as employed, unemployed, or as a member of the inactive population;

• if employed, s/he is in a certain occupation.

Consequently, it is useful to view the gender segregation of the population as arising from three different sources: the segregation induced by the age/education characteristics; the one resulting from the current distribution of people according to labor market status; and the segregation due to the occupational choices of the employed individuals, which is the only one usually studied in the literature.

In order to measure this multidimensional phenomenon using the same metric, assume that we can classify the population according to three variables indexed by $k = 1,\ldots,K$; $i = 1,\ldots,I$; and $j = 1,\ldots,J$. Let F_{kij} and T_{kij} be the number of females and the number of people with characteristics i, k and j, respectively, and let $w_{kij} = F_{kij}/T_{kij}$. Similarly, let F_{ki} and T_{ki} be the number of females and the number of people with characteristics i and k, respectively, and let $w_{ki} = F_{ki}/T_{ki}$. In

the present context, let K, I, and J be the number of labor market status, age/education characteristics, and occupations, respectively. Assume that the value k = 1 corresponds to those employed. Of course, the unemployed and those out of the labor force have no occupation. This means that the transformation we are actually interested in is the one which leads directly from the proportions (W, (1 –W)) to the proportions (w_{1ij}, (1 – w_{1ij})) for the employed population, and to the proportions (w_{ki}, (1 – w_{ki})) for all k ≠ 1. Therefore, as shown in the Appendix, the overall index of segregation can be written as follows:

$$I^* = \Sigma_i \Sigma_{k\neq 1} (T_{ki}/T) I^{ki} + \Sigma_i \Sigma_j (T_{1ij}/T) I^{1ij},$$

where $I^{ki} = w_{ki} \log (w_{ki}/W) + (1 - w_{ki}) \log ((1 - w_{ki})/(1 - W))$, and $I^{1ij} = w_{1ij} \log (w_{1ij}/W) + (1 - w_{1ij}) \log ((1 - w_{1ij})/(1 - W))$.

For empirical reasons which will be apparent in the next Section, we will concentrate in the decomposition which takes the partition into labor participation status as the leading one. In this case, as shown in equation (f) in the Appendix, we can decompose the overall gender segregation index into the following three terms:

$$I^* = I^B_{(k)} + (T_1/T) \hat{I}^B_{(j)} + [(T_1/T) \hat{I}^{Wi}_{(j)} + \Sigma_{k\neq 1} (T_k/T) I_k], \quad (4)$$

The term $I^B_{(k)}$ measures the gender segregation directly induced by labor market participation decisions. The term $\hat{I}^B_{(j)}$ measures the gender segregation induced directly by the occupational decisions in the employed population, and appears in equation (4) appropriately scaled down by the importance of the employed population in the population at large, T_1/T. The term in brackets in equation (4)

measures the gender segregation induced by age/education characteristics both within the partition by occupations in the employed population, as well as within the remaining labor market categories in the total population. In order to analyze the overall gender segregation in each of the subgroups of the fundamental partition by labor market participation decisions, it is convenient to have:

$$I^* = \Sigma_k \, (T_k/T) \, I(k), \tag{5}$$

where $I(1) = I^1 + (T_1/T) \, \hat{I}^B_{(j)} + (T_1/T) \, \hat{I}^{Wi}_{(j)}$ for the employed population, and $I(k) = I^k + I_{ki}$ when $k \neq 1$.

Before we finish this measurement Section, a second decomposition of overall segregation where the human capital partition by age/education characteristics takes the center stage should be presented. In this case, as shown in equation (g) in the Appendix,

$$I^* = I^B_{(i)} + I^{Wk}_{(i)} + (T_1/T) \, \hat{I}^{Wj}_{(i)}, \tag{6}$$

The term $I^B_{(i)}$ measures the gender segregation directly induced by age/education characteristics. The within-group term $I^{Wk}_{(i)}$ measures the gender segregation induced by labor market participation decisions within the partition by age/education characteristics. The term $\hat{I}^{Wj}_{(i)}$ measures the gender segregation induced by occupational decisions within the partition by age/education characteristics in the employed population, and appears in equation (6) appropriately scaled down by the importance of the employed population in the population at large, T_1/T. Finally, in order to analyze overall segregation in each of the subgroups of this partition, we can write

$$I^* = \Sigma_i (T_i/T)\, I(i), \qquad (7)$$

where, for each i, $I(i) = I^i + I_i + (T_1/T)\, I'_i$, where:

$$I^i = W_i \log (W_i/W) + (1 - W_i) \log ((1 - W_i)/(1 - W));$$

$$I_i = \Sigma_k (T_{ki}/k)\, I_{ik},$$

$$I_{ik} = w_{ik} \log (w_{ik}/W_i) + (1 - w_{ik}) \log ((1 - w_{ik})/(1 - W_i));$$

$$I'_i = (T_{1i}/T_i)\, I'_{i1},$$

$$I'_{i1} = \Sigma_j (T_{i1j}/T_{1i})\, I_{i1j}.$$

Notice that, as explained in Mora and Ruiz-Castillo (2000), all weighted gender segregation indexes are bounded above by a certain entropy measure which, in turn, when logarithms are in base 2 is bounded above by 1. However, unweighted direct segregation indexes are bounded only from below.

III. THE SEGREGATION OF THE POPULATION OF WORKING AGE IN 1977

III. 1. Between-group Segregation in the Partitions By Age, Education, and Labor Market Status

As pointed out in the Appendix, our target population in 1977 consists of 23,711,000 individuals, 53.1 per cent of which are females. In the first three columns of Table 1, we present the frequency distribution of females, males, and the total population, respectively, classified in four panels by age, education, a combination of these two variables, and labor market participation. There are three age subgroups, four education subgroups, eleven age/education subgroups, and five labor market categories, indexed by a = 1, 2, 3, e = 1,..., 4, i = 1,..., 11, and k

= 1,...,5, respectively –see the Appendix for a discussion of the data. Column 4 provides the percentage of females in each cell, while column 5 informs about the direct segregation indexes I^a, I^e, I^i, and I^k, defined in equation (1), and their bootstrapped 1% and 99% bounds. For ease of interpretation, all index numbers are multiplied by 100.

Table 1 around here

As far as the age and education variables, there are three points to be noticed. In the first place, we observe that, as expected, the frequency distribution by age is very similar for both genders, except for a greater percentage of older females –a well known fact in many countries which reflects the greater life expectancy of this gender. Consequently, the percentage of females in each age cell does not differ much from the one for the population as a whole. Hence, the segregation index in each age bracket is very small indeed. The value which appears in column 5 and the last row of the first panel is the between-group segregation index $I^B_{(a)}$, that is to say, the weighted average of the segregation indexes in each age cell, with weights given (in column 3) by the relative importance of each age group in the population as a whole: (0.04) 0.24 + (0.13) 0.36 + (0.19) 0.40 = 0.13.

In the second place, we observe that still in 1977 as much as 27 per cent of the Spanish population had a low education (either illiterate or without studies), while only 13.6 per cent had a secondary or a College education (see column 3). The high percentage of people of both genders with a primary education is surely due to the fact that until very recently compulsory education in Spain had reached only up to that level. However, comparing columns 1 and 2 in Table 1 we

see that there are considerably more females with a low education but about a half with a College education. This probably reveals what many would characterize as a lack of equal study opportunities for females in a not so distant past. In spite of the fact that this gives rise to an apparently large discrepancy between the female percentage in the population as a whole, 53.1, and the female percentages at both extremes of the educational scale (column 4), the segregation index only reaches a minimally significant value of 7.76 for the College education category (column 5). Given the small demographic weight of this subgroup, the between-group gender segregation index induced by educational choices has a value of only $I^B_{(e)} = 0.99$.

In the third place, it might be argued that the educational experience varies considerably with age. As we can see in columns 1 to 3 in the third panel of Table 1, this is certainly the case. Consequently, except for those who have completed a primary education, we find that the direct segregation index I^i clearly rises with age. But this is due to different reasons at different educational levels: the older the age bracket, the greater the percentage of females with a low education, and the smaller the percentage of females with a secondary or a College education. However, due to the large weight of individuals with a primary education, a subgroup for which gender segregation is practically absent, the between-group gender segregation term rises only up to $I^B_{(i)} = 1.23$; the 1 and 99 per cent bounds are 1.10 and 1.42, respectively. Thus, people's educational choices, even when they are combined with age differences, induce a very low degree of gender segregation.

In the last panel of Table 1 we observe drastic differences between genders in the labor market participation decision. As a consequence, among the inactive individuals devoted essentially to housework, 96.1 per cent are females; however, among those employed, only 28.6 are females. Therefore, the segregation indexes in these two cells are 68.0 and 17.9, respectively. The weighted average over all labor market categories is $I^{B}_{(k)} = 34.2$, a relatively high value, whose bootstrapped lower and upper bounds are 33.6 and 35.1, respectively.

Clearly, the between-group term for this partition is much larger than for the partition which reflects the human capital investment decisions in formal education in different age brackets. Therefore, gender segregation at this stage can be conveniently expressed as $I^{B}_{(k)} + I^{Wi}_{(k)}$ rather than as $I^{B}_{(i)} + I^{Wk}_{(i)}$. But before we finish this Subsection, it is instructive to examine in some detail the term $I^{Wi}_{(k)}$.

We have seen that the female percentage of the population as a whole is not that different from the female percentages in each age/education subgroup. However, we expect the age/education profile of employed females, for example, to be very different from the one of females engaged in housework. These differences are illustrated in column 1 of Table 2. We observe that females with a low education represent 17.4 per cent of all the employed females but as many as 33.4 per cent of females devoted to housework; conversely, the percentage of females with a College degree in these two subgroups are 5.6 and 1.1 per cent, respectively.

Table 2 around here

Do such patterns lead to large differences in the segregation indexes within

these two subgroups? They do not. The reason is that the male distributions by age/education characteristics are very similar to the females ones (column 2 in Table 2). Consequently, the set of female percentages w_{ki}, i = 1,...,11, are not very different from the corresponding female proportions in these two subgroups, W_1 = 28.6 and W_5 = 96.1 per cent, respectively (column 4). Therefore, the segregation indexes in each cell, I_{ki}, are all small[5] (column 5), giving rise to low weighted index values: I_1 = 1.8 and I_5 = 0.8 in these two cases. Since something very similar occurs for the 3 remaining labor market categories –details are available on request- we find that the within-group term in this decomposition is very low indeed, $I^{Wi}_{(k)} = \Sigma_k (T_k/T) I_k = 1.6$.

In brief, gender segregation at this stage is seen to be equal to $I^{B}_{(k)} + I^{Wi}_{(k)} =$ 34.7 + 1.6 = 36.3. The ratio 100(34.7)/36.3 = 96.6 is very high, and the interpretation is clear: 96.6 per cent of the gender segregation created so far is due to the labor market participation choice. The part of overall segregation attributable to the human capital investment in education, even when we take into account the age effects, is of a small order of magnitude.

III. 2. The Gender Segregation Induced By Occupational Choices and Age/education Characteristics In the Employed Population

In order to study the gender segregation induced by occupational choices, we concentrate on the employed population. In this way, the results of this Subsection correspond to the usual case studied in the literature. Because broader categories mask some of the segregation in the more detailed categories within

them [England (1981)], researchers have always sought to work with the largest possible number of occupations[6]. However, the idea that, *ceteris paribus*, the larger the number of occupations the better, has been questioned because of the possible bias due to small cell size [Blau *et al.* (1998)]: random allocations of individuals across occupations may generate relatively high levels of gender segregation purely by chance. Moreover, in this paper occupations must be large enough in order to be meaningfully partitioned by age/education characteristics. Given that we are limited by a relatively small sample size because our data come from a labor force survey rather than a Census, we need to search for the smallest possible set of occupations.

Using an algorithm based on the bootstrap, Mora and Ruiz-Castillo (2000) show that in 1977 an original list of 107 occupations can be aggregated into 29 occupational categories, which are fully described in Appendix II. These occupations can be conveniently classified into three main categories: 11 male occupations, 12 female occupations, and 6 integrated occupations. In turn, each of these categories can be further divided into a maximum of four groups, depending on whether they contain agricultural, blue collar, white collar, as well as professional and managerial occupations. In addition, male occupations include the armed forces. This gives a total of 12 aggregate categories.

Table A in Appendix I presents some descriptive statistics for the 29 occupations. Approximately 15 per cent of males and females are employed in integrated occupations in 1977. However, 64.7 and 19.9 per cent of males are employed in male and female occupations, respectively, while for females these

percentages become 10.5 and 72.2 per cent, respectively. Overall, 49, 16 and 35 per cent of the population are employed in male, integrated and female occupations, respectively. From another perspective, 20.7 per cent of the population has a job in the agricultural sector, 39.1, 27.2, and 12.2 per cent in blue collar, white collar, and professional and managerial occupations, respectively, while the remaining 0.8 per cent is in the armed forces.

The gender segregation in the employed population, $\hat{I}$, can be decomposed into two terms which measure the direct gender segregation in all occupations, $\hat{I}^{B}_{(j)}$, and the gender segregation induced by age/education characteristics within the partition by occupations, $\hat{I}^{Wi}_{(j)}$. Table A in Appendix I presents detailed information at the 29 occupations level on the following four statistics: the direct gender segregation indexes induced by occupational choices, $\hat{I}^{j}$, the gender segregation indexes induced by age/education characteristics within each occupation, $\hat{I}_j$; the total segregation indexes, each of which is the sum of the previous two: $\hat{I}(j) = \hat{I}^{j} + \hat{I}_j$; and the ratio:

$$\alpha_j = [((T_{1j}/T_1)\,\hat{I}(j))/\hat{I}]/(T_{1j}/T_1) = \hat{I}(j)/\hat{I},$$

where the numerator is the j-th occupation relative contribution to the total gender segregation $\hat{I}$, and the denominator is this occupation's demographic importance within the employed population. Therefore, when $\alpha_j > 1$ (< 1), this ratio indicates that occupation j is contributing to total gender segregation above (below) what we could expect from its demographic weight. By way of summary, Table 3 reports the corresponding weighted averages for the 12 aggregate

categories.

Table 3 around here

The direct segregation index for any occupation, $\hat{I}^j$, results from the discrepancy between the proportion of females in the employed population, W_1 = 28.6 per cent, and the proportion of females in that occupation, w_{1j} (see column 4 in Table A in Appendix I). Naturally, the direct segregation indexes reach high values in the male and female occupations, and low values in the integrated occupations (see column 5 in Table A and column 1 in Table 3). The between-group term $\hat{I}^B_{(j)}$ is equal to 27.2.

In Table 1 we saw that the index of direct segregation $I^B_{(i)}$ for the entire population is only 1.23. In Table 2 we saw that the gender segregation induced by the age/education characteristics within the employed population, I_1, also has a low value of 1.76. In the same vein, in the last row of column 2 in Table 3 the within-group segregation in the partition by occupations, $\hat{I}^{wi}_{(j)}$, is only 3.4. According to column 6 in Table A, $\hat{I}_j$ is above 8.0 in only four cases (occupation 13, a blue collar integrated occupation; occupation 18, an agricultural female occupation, and occupations 22 and 27, both female white collar occupations).

In the last row of Table 3 we find that total gender segregation in the employed population is equal to $\hat{I}$ = 27.2 + 3.4 = 30.6, whilst the bootstrapped lower and upper bounds are 30.1 and 31.8, respectively. The ratio 100(3.4)/30.6 = 11.1 indicates that age/education characteristics explain 11.1 per cent of the total gender segregation among the employed population –a relatively low figure that

is, however, considerably greater than the one we obtained for this variable within the partition of the entire population by labor market categories. As far as the variation of the total gender segregation across occupations, column 4 in Table 3 indicates that, on average, female occupations contribute to total gender segregation 44 per cent more than what we could expect from their demographic weight. This is particularly the case for blue collar and white collar occupations, although blue collar male occupations and the armed forces contribute 18 and 59 per cent more than their demographic weight. On the contrary, integrated occupations as a whole contribute almost 80 per cent less than what we could expect from their demographic importance.

III.3. The Overall Segregation for the Population as a Whole

According to equation (4), the overall segregation at a given moment in time can be seen to arise from three sources, the discrepancy between: (i) the female percentage in the population, W, and the female percentages in each labor market participation subgroup, W_k, k = 1,...,5, reflected in the first between-group term, $I^B_{(k)}$; (ii) the female percentage in the employed population, W_1, and the female percentages in each occupation, w_{1j}, j= 1,..., 29, reflected in the second between-group term, $\hat{I}^B_{(j)}$, appropriately scaled down by the factor (T_1/T); and (iii) on one hand, the female percentage in each occupation, w_{1j}, and the female percentages in this occupation and each age/education characteristic, w_{1ji}, i = 1,..., 11; and on the other hand, the female percentage in each labor market status, W_k with $k \neq 1$, and the female percentages in that labor market status and each

age/education characteristic, w_{ki}, i = 1,...,11. Thus, we have:

$$I^* = I^B_{(k)} + (T_1/T)\hat{I}^B_{(j)} + [(T_1/T)\hat{I}^{Wi}_{(j)} + \Sigma_{k\neq 1}\,(T_k/T)\,I_k]$$

$$= 34.2 + 14.0 + 2.5 = 50.6.$$

Therefore, in 1977 the labor market status and the occupational decisions account for 100 $(I^B_{(k)})/I^*$ = 67.6 and 100 $((T_1/T)\hat{I}^B_{(j)})/I^*$ = 27.7 per cent, respectively, of the overall gender segregation. The remaining residual, 4.7 per cent, is accounted for by the age/education characteristics.

The final issue to investigate is the relative contribution to overall segregation by each labor market subgroup. As we saw in equation (5), the overall segregation index can be written as $I^* = \Sigma_k\,(T_k/T)\,I(k)$, where $I(1) = I^1 + (T_1/T)\hat{I}^B_{(j)}$ + $(T_1/T)\hat{I}^{Wi}_{(j)}$, and $I(k) = I^k + I_k$ when $k \neq 1$. The relevant information is in Table 4, whose last column is the ratio

$$\alpha_k = [((T_k/T)\,I(k))/I^*]/(T_k/T) = I(k)/I^*.$$

When $\alpha_k > 1$ (< 1), this ratio indicates that subgroup k is contributing to overall segregation above (below) what we could expect from its demographic weight.

Table 4 around here

The following four features should be emphasized in Table 4. First, the subgroup of people engaged in housework, which represents slightly over one third of the population, contributes to overall gender segregation 36 per cent more than what we would expect from its demographic weight. Almost all of this contribution is due to the segregation induced by labor market participation decisions. Second, at the opposite end of the spectrum, unemployed people

having worked before and the subgroup consisting of pensioners and disabled workers, which represent only 0.8 and 11.4 per cent of the population, contribute to overall gender segregation 96 and 82 per cent, respectively, below what we would expect from its demographic weight. Third, the important subgroup of the employed, which represents 51.2 per cent of the population, contributes 4 per cent less than what we would expect from its demographic weight. Finally, the gender segregation induced by the labor market participation and the occupational decisions among the employed, is equal to 100 (17.9)/48.6 = 36.8 and 100 (27.3)/48.6 = 56.2 per cent of overall segregation, respectively. The remaining 7.0 per cent can be attributed to the age/education characteristics.

IV. THE RECENT EVOLUTION OF GENDER SEGREGATION IN SPAIN

IV. 1. The Evolution of Between-group Gender Segregation Induced by Age/education Characteristics, Labor Market Participation and Occupational Choices

As pointed out in the Appendix, the Spanish EPA provides comparable data for the period 1977-1992. This is an interesting period because there are important changes in male and female behavior relating to the investment in human capital through formal education, labor market participation and occupational choices. Taking into account that the percentage of females in the population as a whole -which is now equal to 51.9 per cent- has remained practically stable, these changes should affect our estimates of gender segregation in the three dimensions we are concerned with.

The information about the population in 1992 relative to the first dimension is in the first panel of Table 5. The comparison with the third panel in

Table 1 shows the following differences. In the first place, as a consequence of the decline in fertility and the increase in life expectancy, the proportion of males and females over 50 years of age has increased by 3.0 and 4.4 percentage points, respectively. In the second place, there has been a remarkable improvement in educational achievements. As a result, 23.4 per cent of the population has a low education (versus 27.1 per cent in 1977), whereas 35.3 per cent has a secondary or a College education (versus 13.6 per cent in 1977).

Table 5 around here

What are the implications of this upgrading in educational achievements, particularly among the young, for the gender segregation induced by age/education characteristics? In our framework, differences in gender segregation must come from gender differences in the above patterns. The comparison of column 1 in Tables 1 (third panel) and 5, indicates that the proportion of females with a secondary or a College education has increased, approximately, by a factor of 3 and 2.5, respectively, while the proportion with a low education or, above all, with a primary one, has decreased dramatically. However, judging from the evidence presented in column 2 of these Tables, something similar has also taken place among the males. Nevertheless, the female percentage among people over 30 with a secondary education, as well as among people of all ages with a College degree, has increased, while the female percentage among young people with a primary or a secondary education has decreased. Consequently, for people over 30 with a secondary or a College education, the gender segregation indexes have decreased; but this is offset by the increase in the indexes for the young, including those with a College degree,

where the proportion of females is now 61.1 per cent -almost 10 percentage points above the female proportion for the population as a whole. As a result, the between-group gender segregation induced by age/education characteristics is now $I^{B}_{(i)} = 1.06$, the same low order of magnitude as in 1977. Similarly, the within-group term, $I^{Wi}_{(k)}$, is now equal to 1.7 while in 1977 it was equal to 1.6.

The conclusion is inescapable. The Spanish population in 1992 is considerably more educated than in 1977. But in spite of the fact that the investment in human capital has been particularly large among females, people's educational choices in 1992 again induce a very low degree of gender segregation(7).

The comparison of the lower panel in Table 5 and the fourth panel in Table 1, shows drastic changes in the relation to economic activity. Unemployment has increased from 2.6 to 8.7 per cent, while the employed population now represents 6.9 percentage points less than in 1977. The inactive population has remained approximately constant, but its composition has changed: there has been an increase of 4.1 percentage points in the retired population, comprising pensioners and the disabled, offset by a corresponding decrease of people devoted to housework, which still represents as much as 31.5 per cent of the population.

These trends are the consequence of rather different variations in gender patterns. Among females, the proportion of people devoted to housework has been reduced by 7.2 percentage points, which is approximately the amount by which female unemployment has increased; most of this increase takes place among those unemployed, presumably the young, searching for a first job.

Among males, the employed now represent 16.2 percentage points less than in 1977; the corresponding increase takes place among the unemployed -especially, among those searching for a first job- and the early retired in our category of pensioners and the disabled. As a result, the proportion of females increases in all categories within the active population, and decreases in both categories within the inactive population. The direct segregation indexes in the "housework" and "searching for a first job" categories and, to a smaller extent, among the employed, decrease dramatically. This novelty is only partially offset by the increase in gender segregation in the remaining two categories. Therefore, the between-group component $I^{B}_{(k)}$ becomes equal to 23.2, 32.2 per cent less than its value in 1977.

Table B in Appendix I presents the descriptive statistics and the gender segregation indexes in the partition of the employed population by 29 occupations in 1992, while the summary information for the 12 aggregate occupational categories is in the right-hand panel of Table 3. The pattern of gender segregation in 1992 induced by occupational choices and by age/education characteristics within occupations (column 5 and 6 in Table 3, respectively), is essentially the same as in 1977. Perhaps the main difference is that whereas, relative to their demographic importance, the contribution of female occupations to total gender segregation decreases somewhat, it increases slightly for blue collar male occupations and the armed forces (column 8 *versus* column 4 in Table 3).

As pointed out in Mora and Ruiz-Castillo (2000), together with the decline in agriculture, as well as in integrated and female blue collar occupations, the most important change in total employment structure during the 1977-1992

period is the terciarization of the economy induced mostly by the increase in the size of the public sector. Such changes in the occupational mix cause a slight increase in gender segregation. This is offset by a decrease attributable to changes in the gender composition in a scenario characterized by a considerable increase in the female labor participation rate from 28.6 to 32.9 per cent of the employed population[8]. The net result is a slight decrease of 0.6 index points in the between-group term $\hat{I}^{B}_{(j)}$, which captures the direct gender segregation induced by occupational choices[9].

The within-group term $\hat{I}^{Wi}_{(j)}$ also decreases from 3.4 to 2.1 index points. Consequently, total gender segregation goes down by 1.8 index points, or 5.9 per cent relative to the level reached in 1977. However, since the proportion of employed people has gone down from 51.2 in 1977 to 44.3 per cent in 1992, the term $(T_1/T)\,\hat{I}^{B}_{(j)}$ decreases to 11.8, about 15 per cent below that in 1977.

IV. 2. The Evolution of Overall Gender Segregation

To sum up, we have that overall gender segregation in 1992 can be expressed as

$$I^{*} = I^{B}_{(k)} + (T_1/T)\hat{I}^{B}_{(j)} + [(T_1/T)\hat{I}^{Wi}_{(j)} + \Sigma_{k\neq 1}\,(T_k/T)\,I_k]$$

$$= 23.2 + 11.8 + 1.9 = 36.9.$$

Thus, in 1992 the labor market status and the occupational decisions account for $100\,(I^{B}_{(k)})/I^{*} = 62.8$ and $100\,((T_1/T)\,\hat{I}^{B}_{(j)})/I^{*} = 32.0$ per cent, respectively, of overall gender segregation. The remaining residual, 5.2 per cent, is accounted for by the age/education characteristics. The main difference with 1977 is the decline of 4.8

percentage points in the share of $I^{B}_{(k)}$ in favor, essentially, of the segregation induced by occupational choices.

The details by labor market categories are in Table 6. Two points should be emphasized. In the first place, it has been already verified that the direct segregation indexes of the employed and those devoted to housework have decreased. However, their demographic weights have also suffered a severe reduction. As a result, both subgroups contribute to overall segregation 8 and 41 per cent, respectively, above what we would expect from their demographic importance. In the second place, the gender segregation induced by the labor market participation and the occupational decisions among the employed, is equal to 100 (10.9)/39.8 = 27.4 and 100 (26.7)/39.8 = 67.1 per cent of overall segregation, respectively. The remaining 5.5 per cent can be attributed to the age/education characteristics. The main change is that the gender segregation induced by occupational choices now represents 10.9 percentage points more than in 1977; most of this increase is matched by a decrease in 9.4 percentage points in the relative importance of the gender segregation induced by labor market participation decisions.

Table 6 around here

When we compare the overall gender segregation in the two periods –50.6 and 36.9, respectively- we find that in 1992 it is 13.7 points, or 27 per cent, lower than in 1977. However, in so far as a segregation index is a weighted average of segregation indexes across one or more relevant partitions, changes in overall segregation must be expressed as the sum of changes in the demographic weights, and changes in the gender composition which give rise to changes in the segregation

indexes themselves. Let $\Delta I(k) = I(k)_{93} - I(k)_{77}$, be the increment in the segregation index during the 1977-1992 period for each labor market category k = 1,...,5. If $\Delta I^* = I^*_{93} - I^*_{77}$ is the increment in the segregation index for the entire population, then in equation (h) in the Appendix we show that

$$\Delta I^* = \Delta I(k) = \Sigma_k (S^k_k + S^i_k + S^j_k + D_k), \qquad (8)$$

where, for each k, S^m_k, m = k, i, j, is the part of the overall change within category k attributed to the change in the segregation induced by labor market participation decisions, occupation decisions and age/education characteristics, respectively, holding constant the demographic shares at their 1977 levels; D_k is the part of the overall change attributed to changes in the demographic shares. The information about all terms in equation (8) is in Table 7.

Table 7 around here

The first thing to notice, is that changes in gender segregation indexes induced by occupations (column 2) or age/education characteristics (column 3) are very small indeed. Most of the reduction in overall segregation must be attributed to a decrease in the segregation induced by labor market participation decisions and, to a lesser extent, to the changes in demographic weights. As far as the role of specific subgroups is concerned, the main feature in Table 7 is that the subgroups mainly responsible for the decrease in overall segregation are the employed and the inactive devoted to housework. In both cases, the main sources of such a decrease are the reduction in segregation induced by labor market participation decisions –which account for 3.6 and 6.1 points, respectively- and the decrease in

their respective demographic weight –which accounts for 2.1 and 1.9 points, respectively.

As we indicated in the Appendix, 1977 and 1992 occupy similar positions in the first stage of two recessions. The remaining question is whether the change in gender segregation during this period is very much affected by the business cycle or if it follows an independent trend of its own. A partial answer is offered in Figure 1.

Figure 1 around here

Figure 1.A. refers to some of the main forces behind the change in gender segregation induced by labor market choices, namely, the change in the female percentages among the employed and those devoted to housework. The discontinuity in 1987 is a consequence of a methodological change in the Spanish survey. Apart from that, the decline of the female percentage in housework and the increase within the employed subgroup proceed uniformly throughout the period. Consequently, the index of gender segregation induced by labor market participation decisions, $I^{B}_{(k)}$, also declines uniformly in Figure 1.B. On the other hand, the index of gender segregation induced by occupational choices remains essentially constant during the entire period.

Therefore, the main indicators responsible for the 13.7 decrease in overall gender segregation do not behave cyclically. Instead, during this period, they appear to respond to forces which are proceeding rather uniformly through time.

V. AN ALTERNATIVE PERSPECTIVE

We have seen that most of the overall gender segregation in Spain takes

place not between age/education subgroups but within them. Nevertheless, although age/education characteristics do not create much gender segregation by themselves, it is interesting to study how gender segregation induced by labor market participation and occupational decisions varies across specific age/education subgroups.

For this purpose, equation (6) in Section II provides an alternative way to express overall segregation as the sum of three terms: a between-group term $I^{B}_{(i)} = \Sigma_i (T_i/T) I^i$, which measures the segregation induced directly by age/education characteristics; a first within-group term $I^{Wk}_{(i)} = \Sigma_i (T_i/T) I_i$, which measures the segregation induced by labor market participation decisions within the partition by age/education characteristics; and a second within-group term $\hat{I}^{Wj}_{(i)} = \Sigma_i (T_i/T) I'_i$, which measures the segregation induced by occupational choices in that same partition. The information for 1977 and 1992 is in Table 8.

Table 8 around here

Column 1 in Table 8 simply reproduces the direct gender segregation in each age/education cell in 1977 and 1992 (column 5 in the third panel in Table 1 and the first panel of Table 4, respectively). In 20 of the 22 cases, direct segregation indexes belong to the small interval [0.0, 7.5]; the remaining 2 indexes (for subgroups 10 and 11 in 1977), have a slightly larger range of variation from 10.9 to 16.7.

Column 2 presents the segregation indexes induced by labor market participation choices. In 1977, the subgroups 4, 7, and 10, consisting of people 31-

50 years of age, show the maximum segregation within all educational categories. However, in 1992 the pattern has changed: gender segregation increases monotonically with age in all educational categories. This surely reflects the fact that the shift observed during this period from housework to active participation in the labor force, has been more prevalent among the younger females.

Column 3 presents the segregation indexes induced by occupational choices. Interestingly enough, in both years the segregation among the old is smaller than among the previous age brackets in all educational categories. Except for the lower educated, the proportion of females among the employed in 1977 decreases monotonically with age in all educational categories (see column 4 in the upper part of Table 2). Although not shown here, the same is true for 1992. But it would appear that, at every educational level, those females who remain employed in the later part of their life-cycle are less segregated by occupation than at the beginning of their employment career.

Column 4 presents the overall segregation indexes $I(i) = I^i + I_i + I'_i$, while column 5 presents the ratio $I(i)/I^*$ for every i. In both periods, the subgroups between 31 and 50 and primary or secondary education (4 and 7), which represent about one quarter of the population, contribute between 11 to 33 per cent more to overall gender segregation than what we would expect from their demographic weight. About two thirds of this contribution is due to the segregation induced by labor market participation decisions. At the opposite end of the spectrum, young people with a secondary education (subgroup 6) and people with a College degree (subgroups 9, 10, and 11), which represent 9 and 22 per cent of the population in 1977 and 1992, respectively, contribute to overall gender segregation below what

we would expect from their demographic weight. In particular, in 1992 the three College subgroups contribute 61, 38, and 19 per cent less to overall segregation than what we would expect from their demographic weight.

The next task is to learn which are the subgroups mainly responsible for the reduction of 13.7 points in overall gender segregation. As we saw in Section IV, to investigate this question we must separate the reduction in overall segregation into the change in segregation indexes and the change in demographic weights. The analogue to equation (8) for the present partition is

$$\Delta I^* = \Delta I(i) = \Sigma_i (S^k_i + S^i_i + S^j_i + D_i), \qquad (9)$$

where, for each i, S^m_i, m = k, i, j, is the part of the overall change within subgroup i attributed to the change in the segregation induced by labor market participation decisions, occupation decisions and age/education characteristics, respectively, holding constant the demographic shares at their 1977 levels; D_i is the part of the overall change attributed to changes in the demographic shares. The information about all the terms in equation (9) is in Table 9.

Table 9 around here

The following subgroups are responsible for an important part of the overall reduction: people 16-50 years of age with a primary or a low education (subgroups 3 + 4, and 1), which generate a reduction of 13.7 and 3.6 points, respectively. This is the result of a reduction in the segregation induced by labor market participation decisions –6.5 points- and, above all, in demographic weights –10.5 points. On the other hand, essentially as a consequence of their demographic increase, people 16-50 years of age with a secondary education

(subgroups 6 + 7) are responsible for a 4.5 per cent *increase* in overall gender segregation.

Naturally, whether we take the point of view of the partition by age/education characteristics, as in this Section, or by labor market categories, as in Sections III.3 and IV, the facts of the matter are the same. To understand the connection between these two perspectives, let us concentrate on the important subgroup 4, consisting of people 31-50 years of age with a primary education. The segregation indexes induced by labor market participation decisions in both 1977 and 1993 are in Table 10.

Table 10 around here

The first thing to notice is that the female percentage in this subgroup is practically the same in both periods, 51.4 and 52.4 per cent respectively. The difference lies in the importance of the female presence and demographic weights across labor market categories (columns 4 and 3, respectively, in Table 10). As we know, relative to 1977, in 1992 there is a decrease in the percentage of females in the category of people devoted to housework, and an increase among the employed and the unemployed, particularly those in search of a first job. These changes translate into a decrease in the corresponding segregation indexes: from 84.2 to 61.4 in housework; 24.3 to 18.2 in the employed; and 55.4 to 0.4 among the unemployed in search for a firs job. On the other hand, there is a decrease in the demographic weights of those labor market categories with higher segregation indexes (housework and employment), while the opposite is the case for the lowest segregation index subgroup (the unemployed searching for a first job). Consequently, the weighted segregation index I_i decreases from 47.3 in 1977 to 31.8

in 1992.

Such a decrease in the segregation index for the subgroup as a whole, explains why its contribution to the change in gender segregation attributable to labor market participation decisions is so large, i. e., S^k_4 = - 3.0 points in column 1 in Table 9. Likewise, the reduction in the demographic importance of this subgroup in the population as a whole from 23.2 per cent in 1977 to 16.5 per cent in 1992, is the main fact behind its large contribution to the change in gender segregation attributable to demographic factors, i. e., D_4 = - 3.7 points in column 5 in Table 9.

VI. CONCLUDING COMMENTS

VI. 1. Summary

Most of the existing literature studies the gender segregation induced by occupational choices in the employed population. This paper investigates how much of the overall segregation can be attributed to decisions already made before employed individuals are allocated to different occupations. In particular, we offer a framework to study the segregation induced, not only by occupational choices, but also by age/education characteristics and labor market participation decisions in the population consisting of non-students of working age.

For that purpose, we suggest a gender segregation index related to the entropy notion used in information theory. Given any two classification variables, this index satisfies two interesting properties: it is additively decomposable into a between- and a within-group term, and it has a commutability property. Using these properties, overall gender segregation is decomposed into three terms: a first between-group term, which captures the

direct gender segregation induced by labor market participation decisions in the entire population; a second between-group term, which captures the direct gender segregation induced by occupational choices in the employed population; and the sum of two within-group terms, which captures the impact of age/education characteristics within each occupation in the employed population, as well as within the remaining labor market categories.

The interest of this measurement approach is illustrated with Spanish data from the Labor Force Survey in 1977 and 1992, two years for which there is comparable data. At the beginning of this 15 year period, females represent 53.2 per cent of the population, but only 28.6 per cent of those employed and 96.1 of those out of the labor force and devoted to housework. These gender differences in labor market participation behavior constitute the most influential feature generating gender segregation. In brief, in 1977 the percentage of overall generation attributed to labor market participation decisions, occupational choices and age/education characteristics are 67.6, 27.7. and 4.7 per cent, respectively. Among the employed population these figures are 36.8, 56.2, and 7.0 per cent, respectively.

In the fifteen years covered by this study, there have been important changes in the three dimensions we are concerned with. In our framework, behavioral changes translate into changes in gender segregation only if there are important gender differences in the pattern of change. During this period in Spain, this is mainly the case as far as labor market participation decisions are concerned. As a result, the direct gender segregation due to these forces decreases by 32.2 per cent. On the other hand, the direct gender segregation attributable to

occupational choices in the employed population decreases by 0.03 per cent. As far as the combined impact of these changes, in 1992 the percentage of overall segregation attributed to labor market participation decisions, occupational choices and age/education characteristics are 62.8, 32.0, and 5.2 per cent, respectively. Among the employed population, the shift in favor of the occupational source is more pronounced: these figures become 27.4, 67.1, and 5.5 per cent, respectively.

Independently of the shifts in the relative importance of the different sources, the overall gender segregation index decreases from 50.6 in 1977 to 36.9 in 1992, that is, 13.7 index points, or 27 per cent of the 1977 level. This decrease proceeds quite uniformly through time, independently of the business cycle. This change is decomposed into two terms: the part attributable to changes in the gender composition of all subgroups, holding constant the 1977 demographic weights in the partition by labor market categories; and the part attributable to changes in the demographic weights themselves. We find that 67.4 per cent in overall gender segregation is due to the reduction in the gender segregation induced by labor market participation decisions; only 10.9 per cent of the change is due to the reduction in the segregation induced by the other two indexes, and the remaining 21.7 per cent is attributable to changes in the demographic weights.

As we have seen, one of the main results of this paper is that most of the gender segregation in Spain takes place within, rather than between age/education subgroups. However, the additive decomposability property of our measurement instrument permits to study how gender segregation induced by labor market participation or occupational choices varies across specific

age/education subgroups. For instance, we find that (i) in 1992 the gender segregation induced by labor market participation decisions increase monotonically with age in all educational categories; (ii) in both years, the segregation induced by occupational choices follows exactly the opposite pattern.

Probing into the variations across different partitions, the subgroups mainly responsible for the decrease in overall gender segregation from 1977 to 1992 have been isolated, namely: the employed and the inactive devoted to housework, and people 16-50 years of age with a primary or a low education. Finally, the subgroups whose contribution to gender segregation differs greatly from what we can expect from its demographic importance have also been isolated. People devoted to housework, those employed in the female occupations, and those over 30 with a primary or a secondary education, contribute to gender segregation well above their demographic importance; while the opposite is the case for the unemployed, those receiving an old-age or a disability pension, those employed in the integrated occupations and people of all ages with a College education.

VI. 2. Extensions

The measurement instruments used in this paper do not allow us to distinguish which part of gender segregation is due to voluntary choices and technical restrictions, and which part is due to gender discrimination or, in other words, to unequal opportunities for studying, working or being employed in a certain occupation. Nevertheless, if a reduction of overall gender segregation is sought for, it appears that the main hope lies in a continuation of the trend towards less female specialization in housework. Thus, the factors that should be

favored are an independent increase in the male share of child care and housework generally, an increase in the female wage rate, and/or a reduction in the cost of housework activity through, for example, the availability of day care centers at affordable prices. On the other hand, the gender segregation among the employed may decrease if more females enter into the male occupations or, more importantly, if more males get jobs in the traditionally female occupations. Judging from the U.S. experience, this process might be favored by the strong enforcement of laws on equal employment opportunity[10].

When making policy or normative conclusions from our results, it should be remembered that the decomposition analysis which has been presented is merely an accounting exercise which does not treat the possible interdependencies between the factors determining the partitions we have analyzed as endogenous. In this respect, although age/education factors play a small role in overall gender segregation, we have verified that College educated people generate less gender segregation than other educational subgroups. In part, this is probably due to the fact that College educated people tend to have higher rates of employment. Thus, to assess the role of education in diminishing gender segregation, one should explicitly model the link between education and labor participation.

As far as extensions are concerned, it is obvious that it would be interesting to make international comparisons. In the division of labor within the household and the inequality of opportunities to study between the genders, the 1977 Spanish society conforms to the cultural patterns of a traditional Southern European society. Judging from the evolution of labor market

participation decisions and the achievement of higher educational standards during the 1977-1992 period, Spain also appears as a society in transition in gender affairs. One would like to verify: (i) whether other countries in transition in Southern Europe and elsewhere present similar gender segregation patterns; (ii) whether in Northern European and Anglo-Saxon societies, where female labor participation rates are much higher, the overall gender segregation is essentially due to occupational rather than to labor market participation choices; and (iii) whether in underdeveloped countries with even more pronounced traditional gender patterns, age/education characteristics are also responsible for a relatively small degree of gender segregation. It would be also interesting to verify whether there is any connection between female labor market participation rates and the level of gender segregation induced by occupational choices.

Provided we have appropriate data, there are other aspects of gender segregation which can be conceivably investigated with the present tools. We refer to the possibility of estimating the gender segregation induced by either the choice of, say, a scientific, an engineering or a humanistic field of study among College educated people, or by the partition into different categories within the firm's hierarchical structure. Likewise, in countries with racial diversity, one could analyze simultaneously racial and gender segregation using the metric that we have presented in this paper[(11)].

Finally, the results of gender segregation –particularly the segregation induced by occupational choices- might be used as inputs in studies of wage differences between genders.

APPENDIX I

I. The Measurement of Gender Segregation In Our Case

Assume that we can classify the population according to three variables indexed by k = 1,..., K; i = 1,..., I; and j = 1,..., J. Let F_{kij} and T_{kij} be the number of females and the number of people with characteristics i, k and j, respectively, and let $w_{kij} = F_{kij}/T_{kij}$. In the absence of any restrictions, the overall index of direct segregation is defined by:

$$I^{**} = \Sigma_k \Sigma_i \Sigma_j (T_{kij}/T)\, I^{kij}, \qquad (a)$$

where $I^{kij} = w_{kij} \log (w_{kij}/W) + (1 - w_{kij}) \log ((1 - w_{kij})/(1 - W))$. Let F_{ki} and T_{ki} be the number of females and the number of people with characteristics k and i, respectively, and let $w_{ki} = F_{ki}/T_{ki}$. Among other alternatives, it can be shown that the overall segregation index can be decomposed into the following three terms:

$$I^{**} = I^{B}_{(k)} + I^{Wi}_{(k)} + I^{Wj}_{(k)}, \qquad (b)$$

where

$$I^{B}_{(k)} = \Sigma_k (T_k/T)\, I^{k}, \qquad (c)$$

$$I^{k} = W_k \log (W_k/W) + (1 - W_k) \log ((1 - W_k)/(1 - W));$$

$$I^{Wi}_{(k)} = \Sigma_k (T_k/T)\, I_k, \qquad (d)$$

$$I_k = \Sigma_i (T_{ki}/T_i)\, I_{ki},$$

$$I_{ki} = w_{ki} \log (w_{ki}/W_k) + (1 - w_{ki}) \log ((1 - w_{ki})/(1 - W_k));$$

$$I^{Wj}_{(k)} = \Sigma_k (T_k/T)\, I'_k, \qquad (e)$$

$$I'_k = \Sigma_i (T_{ki}/T_k)\, I'_{ki},$$

$$I'_{ki} = \Sigma_j (T_{kij}/T_{ki})\, I_{kij},$$

$$I_{kij} = w_{kij} \log (w_{kij}/w_{ki}) + (1 - w_{kij}) \log ((1 - w_{kij})/(1 - w_{ki})).$$

In our context, let I, K and J be the number of age/education characteristics, labor market status, and occupations, respectively. Assume that the value k = 1 corresponds to those employed. Of course, the unemployed and those out of the labor force have no occupation. This means that the transformation we are actually interested in is the one which leads directly from the proportions (W, (1 –W)) to the proportions $(w_{1ij}, (1 - w_{1ij}))$ for the employed population, and to the proportions $(w_{ki}, (1 - w_{ki}))$ for all $k \neq 1$.To take this restriction into account, let $I^{ikj} = I_{kij} = 0$ for all i, j and $k \neq 1$. Applying this condition in equation (a), the overall index of segregation can be written as follows:

$$I^{*} = \Sigma_i \Sigma_{k \neq 1} (T_{ki}/T)\, I^{ki} + \Sigma_i \Sigma_j (T_{1ij}/T)\, I^{1ij},$$

where $I^{ki} = w_{ki} \log (w_{ki}/W) + (1 - w_{ki}) \log ((1 - w_{ki})/(1 - W))$, and $I^{1ij} = w_{1ij} \log (w_{1ij}/W) + (1 - w_{1ij}) \log ((1 - w_{1ij})/(1 - W))$.

Consider the decomposition which takes equation (b) as a starting point. For the moment, we will retain the first two terms: the between-group term, $I^{B}_{(k)}$,

which captures the direct gender segregation induced by labor market participation decisions –see equation (c); and the first within-group term, $I^{Wi}_{(k)}$, which captures the gender segregation induced by age/education characteristics within each labor market category –see equation (d). But the second within-group term $I^{Wj}_{(k)}$, defined in equation (e), must be appropriately modified. First, notice that we can rewrite it as follows: $I^{Wj}_{(k)} = \Sigma_k \Sigma_i \Sigma_j \, (T_{kij}/T) \, I_{kij}$. Applying the conditions $I_{kij} = 0$ for all i, j and $k \neq 1$ in this expression, we obtain: $I^{Wj}_{(k=1)} = \Sigma_i \, \Sigma_j \, (T_{1ij}/T) \, I_{1ij}$, where $I_{1ij} = w_{1ij} \log (w_{1ij}/w_{1i}) + (1 - w_{1ij}) \log ((1 - w_{1ij})/(1 - w_{1i}))$. The term $I^{Wj}_{(k=1)}$ measures the gender segregation in the total population due to occupational choices within the different age/education subgroups. The corresponding concept in the employed population (see Subsection II.2) can be written as follows:

$$\hat{I}^{Wj}_{(i)} = \Sigma_i \, (T_{1i}/T_1) \, \hat{I}_i = \Sigma_i \, (T_{1i}/T_1) \, \Sigma_j \, (T_{1ij}/T_{1i}) \, I_{1ij} = \Sigma_i \Sigma_j \, (T_{1ij}/T_1) \, I_{1ij}.$$

Therefore, $I^{Wj}_{(k=1)} = (T_1/T) \, \hat{I}^{Wj}_{(i)}$. Thus, gender segregation in the population as a whole is simply the segregation in the employed population, appropriately scaled down by the importance of the employed population in the population at large, T_1/T.

On the other hand, the term $I^{Wi}_{(k)}$ can be written as follows:

$$I^{Wi}_{(k)} = \Sigma_k \, (T_k/T) \, I_k = (T_1/T) \, \Sigma_i \, (T_{1i}/T_i) \, I_{1i} + \Sigma_{k \neq 1} \, (T_k/T) \, I_k.$$

But $I_{1i} = w_{1i} \log (w_{1i}/W_1) + (1 - w_{1i}) \log ((1 - w_{1i})/(1 - W_1)) = \hat{I}^i$, the index of direct gender segregation induced by the i-th age/education category in the employed population. Therefore, $\Sigma_i (T_{1i}/T_i) \, I_{1i} = \hat{I}^B_{(i)}$, so that $I^{Wi}_{(k)} = (T_1/T) \, \hat{I}^B_{(i)} + \Sigma_{k \neq 1} \, (T_k/T) \, I_k$. Hence:

$$\begin{aligned} I^* &= I^B_{(k)} + (T_1/T) \, \hat{I}^B_{(i)} + \Sigma_{k \neq 1} \, (T_k/T) \, I_k + (T_1/T) \, \hat{I}^{Wj}_{(i)} \\ &= I^B_{(k)} + (T_1/T) \, [\hat{I}^B_{(i)} + \hat{I}^{Wj}_{(i)}] + \Sigma_{k \neq 1} \, (T_k/T) \, I_k \\ &= I^B_{(k)} + (T_1/T) \, [\hat{I}^B_{(j)} + \hat{I}^{Wi}_{(j)}] + \Sigma_{k \neq 1} \, (T_k/T) \, I_k, \end{aligned}$$

where the last equality is obtained using the commutative property reflected in equation (3). In conclusion, the overall gender segregation index can be decomposed into the following three terms:

$$I^* = I^B_{(k)} + (T_1/T) \, \hat{I}^B_{(j)} + [(T_1/T) \, \hat{I}^{Wi}_{(j)} + \Sigma_{k \neq 1} \, (T_k/T) \, I_k]. \quad \text{(f)}$$

The term $I^B_{(k)}$ measures the gender segregation directly induced by labor market participation decisions; the term $(T_1/T)\hat{I}^B_{(j)}$ measures the gender segregation induced by occupations; and the term in brackets measures the gender segregation induced by age/education characteristics both within the partition by occupations in the employed population, as well as within the remaining labor market categories in the total population.

Next, a second decomposition of overall segregation is presented in which

the human capital partition by age/education characteristics takes the center stage. Recall that, as we have seen before, $I^* = I^B_{(k)} + I^{Wi}_{(k)} + (T_1/T)\,\hat{I}^{Wj}_{(i)}$. Applying the commutative property to the pair of classification variables i and k for the population as a whole, we have that $I^B_{(k)} + I^{Wi}_{(k)} = I^B_{(i)} + I^{Wk}_{(i)}$. Therefore,

$$I^* = I^B_{(i)} + I^{Wk}_{(i)} + (T_1/T)\,\hat{I}^{Wj}_{(i)}. \qquad (g)$$

The term $I^B_{(i)}$ measures the gender segregation directly induced by age/education characteristics. The within-group term $I^{Wk}_{(i)}$ measures the gender segregation induced by labor market participation decisions within the partition by age/education characteristics. The within-group term $\hat{I}^{Wj}_{(i)}$ measures the gender segregation induced by occupational decisions within the partition by age/education characteristics in the employed population, and appears in equation (g) appropriately scaled down by the importance of the employed population in the population at large, T_1/T.

Finally, let $\Delta I^* = I^*_{93} - I^*_{77}$, $\Delta I^B_{(k)} = I^B_{(k)93} - I^B_{(k)77}$, $\Delta I^{Wi}_{(k)} = I^{Wi}_{(k)93} - I^{Wi}_{(k)77}$, and $\Delta I^{Wj}_{(k=1)} = I^{Wj}_{(k=1)93} - I^{Wj}_{(k=1)77}$. It can be shown that: (i) $\Delta I^B_{(k)} = \Sigma_k (S^k_k + D^1_k)$, where:

$$S^k_k = (T_{k77}/T_{77})\,(I^k_{93} - I^k_{77}),\ D^1_k = [(T_{k93}/T_{93}) - (T_{k77}/T_{77})]\,I^k_{93};$$

(ii) $\Delta I^{Wi}_{(k)} = \Sigma_k (S^i_k + D^i_k + D^2_k)$, where:

$$S^i_k = \Sigma_i (T_{ki77}/T_{77})(I_{ki93} - I_{ki77}),\ D^i_k = (T_{k77}/T_{77})\Sigma_i[(T_{ki93}/T_{k93}) - (T_{ki77}/T_{k77})]\,I_{ki93},$$

$$D^2_k = [(T_{k93}/T_{93}) - (T_{k77}/T_{77})]\,\Sigma_i (T_{ki93}/T_{k93}) I_{ki93};$$

and (iii) $\Delta I^{Wj}_{(k=1)} = \Sigma_k (S^j_k + D^j_k + D^3_k)$,

$$S^j_{(k=1)} = \Sigma_{ij} (T_{1ij77}/T_{77})\,(I_{1ij93} - I_{1ij77}),$$

$$D^j_{(k=1)} = (T_{177}/T_{77})\,\Sigma_{ij}[(T_{1ij93}/T_{193}) - (T_{1ij77}/T_{177})]\,I_{1ij93},$$

$$D^3_{(k=1)} = [(T_{193}/T_{93}) - (T_{177}/T_{77})]\,\Sigma_{ij} (T_{1ij93}/T_{193}) I_{1ij93}.$$

Therefore,

$$\Delta I^* = \Sigma_k (S^k_k + S^i_k + S^j_k + D_k) \qquad (h)$$

where $D_k = (D^1_k + D^2_k + D^3_k) + D^k_k + D^j_k$.

II. The Data

The EPA is a labor force survey, consisting of about 50,000 household observations per quarter, representative of the Spanish household population living in private residential housing. It is a rotating panel in which each household is interviewed during 7 consecutive quarters; thus, one eighth of the sample is renewed every quarter. It investigates the relationship with economic activity and other characteristics of every household member over 14 years of age. In this paper, data from the second quarter is taken as representative of the year as a whole.

The time period in this paper starts in 1977, the first year for which micro-

economic data is available in electronic support, and lasts until 1992, the year before a fundamental change in the National Classification of Industries (NCI) took place, making the comparison of our data with the period starting in 1993 impossible. The Spanish economy entered into economic recession and political instability in 1975. The following 10 years are of slow, if not negative, economic growth in real terms. This phase comes to an end in 1985, when the economy starts growing at rates near or above 5 per cent. The expansion lasts until 1992, when growth turned negative. Therefore, both 1977 and 1993 are years of economic stagnation, occupying similar positions in the business cycle.

The legal working age in Spain is 16. According to EPA, the working age population in 1977 is, approximately, 25,000,000 persons, 52.8 per cent of which are females. Almost 6 per cent of the population consists of full-time students, all of whom are, by definition, part of the inactive population. Since we want to analyze the labor market participation choice by every educational category, we are forced to exclude students from the analysis. We also drop Members of the clergy from our sample because it only includes people living in private residential housing, who are mostly male, but it excludes those members of the clergy living in convents and monasteries, who are both male and female. Thus, our target population in 1977 consists of 23,711,000 individuals, 53.2 per cent of which are females.

According to EPA, the employed population in 1977 and 1992 is, approximately, 12,148,346 and 12,361,738 people, respectively. Employed people interviewed in EPA can be classified according to the two-digit NCI of 1974 and the two-digit National Classification of Occupations (NCO) of 1979. In Mora and Ruiz-Castillo (2000) occupations are taken as the basic partition and combined with the list of 2-digit industries to obtain a 107 occupational classification. Using an algorithm based on the bootstrap, an admissible aggregation level of 29 occupational categories is obtained, yielding a gender segregation value which is not significantly different from the maximum gender segregation level obtained from the 107 original occupations. The description of the 107 occupations, as well as their classification into the final 29 categories, is presented in Appendix II.

We have 1410,881 and 139,421 individual observations in 1977 and 1992, respectively. Of course, this decision limits the number of subgroups that we can consider. In particular, we distinguish three age categories (16-30; 31-50; 51-99), four educational attainment levels (illiterates and without formal studies or "low education"; with less than 9 years of education or "primary education"; between 9 and 12 years of education or "secondary education"; and College education); and 11 age/education subgroups (resulting from the combination of the age and education variables, except for the low education category which needs to be combined with a 16-50 age interval). There are five labor market participation situations: employment; two types of unemployment, depending on whether the individual has worked before or s/he is searching for their first job; retired from the active population as a pensioner or as disabled; and another type of inactivity, meaning essentially housework.

III. Descriptive Statistics and Gender Segregation in the Employed Population Induced by Occupational Choices and Age/education characteristics

Table A contains some descriptive statistics for the employed population in 1977, as well as several gender segregation indexes for the 29 occupations. The first three columns of this Table contain the frequency distribution of females, males, and the total population, respectively, while column 4 provides the percentage of females in each occupation. Columns 5, 6, and 7 include the direct segregation index induced by occupational choices, I^j -which is taken from Mora and Ruiz-Castillo (2000)-, the gender segregation index induced by age/education characteristics within each occupation, I_j, and the total segregation index, $I(j) = I^j + I_j$. For ease of interpretation, all index numbers are multiplied by 100.

A distinction is made between male, integrated and female occupations. Given that the female labor participation rate in 1977 is 28.6, a male occupation is defined as one with a female proportion smaller than 18 percent, and a female occupation as one with a female proportion greater than 38 percent. There are 11 male occupations, in which the female percentage varies from 0 to 16.5 per cent; 12 female occupations, in which this percentage varies from 38.9 to 91.0 per cent; and 6 integrated occupations, in which the proportion of females varies from 19.5 to 36.8 per cent. In each case, we distinguish only 4 major groups (plus the armed forces): agriculture; blue collar; white collar; and professionals and managerial. Occupations within each major group are ordered by their demographic importance in the employed population.

Naturally, the direct segregation indexes I^j in the male and female occupations reach high values: from 5.8 to 48.6 in the male occupations (occupations 7 and 11, respectively), and from 5.0 to 124.8[(12)] in the female occupations (occupations 26 and 25, respectively). The indexes in the integrated occupations vary from 0 to 3.1 (occupations 15 and 16, respectively). In the last row of Table A, the overall gender segregation index is seen to be equal to 27.3. Within-group indexes are discussed in the text.

Table A around here

The analogous information for 1992 is in Table B. Among women, there is a decline of 8.2 percentage points in integrated occupations, which gets distributed into male and female occupations in 3.5 and 4.7 per cent, respectively. Among men, the decline in integrated occupations is smaller, 3.8 per cent, and the distribution into male and female occupations is more uneven: 0.5 and 3.3 per cent, respectively. As a consequence, the decline of total employment in integrated occupations is matched by an increase in female occupation jobs. From another perspective, there is a strong reduction in the proportion of jobs in agriculture, a slight decline in blue collar jobs, and an increase in white collar, professional and managerial occupations. The consequences of these trends for gender segregation are analyzed in Section IV in the text.

Table B around here

APPENDIX II

LIST OF 107 ORIGINAL OCCUPATIONS, AGGREGATED INTO THE FINAL 29 OCCUPATIONAL CATEGORIES

OCCUPATION	NCO	Wij	Tij/Ti	Description
MALE				
Agriculture				
1				
	61	15.3	78.9	Independent farmers and fishermen working in agricultural production
	61	21.1	17.4	Independent farmers and fishermen working in livestock production
	62	16.3	3.7	Other agricultural workers, ranchers, ranch hands.
2				
	64	.6	71.9	Fish and game workers
	63	1.0	28.1	Forestry workers
Blue Collar				
3				
	95	.5	23.6	Bricklayers
	95	3.1	23.3	Other construction workers
	98	.5	20.7	Drivers, other transport personnel
	83	5.4	9.7	Foundry workers
	81	4.6	6.1	Furniture makers, carpenters
	85	1.2	5.4	Other electricians
	72	.2	2.9	Iron and steel workers
	71	0,0	2.8	Miners and quarry workers
	73	7.2	2	Wood and paper mill workers
	93	7.1	1.5	Painters
	96	0,0	1.1	Machine operators
	74	0,0	.5	Other chemical laboratory workers
	82	1,0	.4	Stonemasons
4				
	84	1.8	63.3	Mechanics, machinists, watchmakers and other precision mechanics
	87	.6	31.5	Plumbers, welders, sheet metal workers

	79	9.2	2.7	Upholsterers
	80	10.7	2.5	Shoemakers working in repair services
5				
	99	11.9	48.9	Unskilled agriculture and industry workers not classified in other subgroups
	99	9.8	26.9	Unskilled service workers not classified in other subgroups
	92	11.5	21.7	Graphic arts workers
	76	15,0	2.6	Furriers, leather workers
White Collar				
6				
	58	1.7	42.8	Personnel in protection and security services
	70	4.6	30.7	Foremen, overseers
	37	4.8	20	Mailroom workers, office assistants
	36	3.4	6.5	Engineers, inspectors and conductors in passenger transport
7				
	33	15,0	61.7	Other employees in accounting, cashier, teller positions
	16	17.8	15.3	Sculptors, painters, decorators, photographers
	11	18.8	10.7	Accountants and bookkeepers
	45	20.9	10	Sales assistants and sales representatives working in wholesale trade
	34	17.6	2.3	Adding machine operators, data processors
8				
	43	2.1	85.6	Sales personnel, sales representatives
	44	5,0	14.4	Stockbrokers, bonds brokers, real estate agents, insurance brokers
Professional Managerial				
9				
	21	2.7	47.4	Companies directors and managers
	31	10.2	23.5	Head clerks, office managers
	41	2.2	9.4	Owners or managers of commercial establishments working in wholesale trade
	42	4.7	6.9	Head of sales, head buyers
	35	4.9	3.4	Inspectors of transport and communication services
	60	2,0	3.2	Operator of agricultural or fishing enterprises
	41	5,0	3.1	Other owners or managers of commercial establishments

	40	4.8	1.7	Directors, managers of commercial establishments
	50	8.4	1.1	Directors, hotel managers, restaurant services
	20	7.6	.4	Members of governmental branches
10				
	3	4,0	59.3	Draftsmen, engineering technicians
	12	5.7	15.3	Legal professionals
	2	2.4	14.2	Architects and engineers
	4	0,0	4	Pilots, air and maritime navigation officers
	1	8,0	3.9	Chemists, physicists, geologists
	9	0,0	3.2	Economists
Armed Forces				
11				
	25	0,0	100	Members of the Armed Forces
INTEGRATED				
Agriculture				
12				
	62	36.8	100	Agricultural workers, ranchers, ranch hands working in farms
Blue Collar				
13				
	97	19.9	28.9	Other cargo handlers
	97	21.1	26	Cargo handlers working in agriculture and mining
	89	21.9	20.7	Glass, ceramic factory workers
	90	22.7	14.1	Rubber, plastic manufacturing plant workers
	74	23.1	10.2	Chemical laboratory workers working in chemicals and allied products
14				
	77	32,0	100	Food, drink preparation workers working in food and kindred products
15				
	85	28.5	56	Electricians working in equipment manufacturing
	94	35.1	28.3	Crafts people and similar not classified in above subgroups
	88	19.9	15.7	Jewelers and silversmiths
Professional Managerial				
16				
	6	20.2	63	Physicians, veterinarians, pharmacists

	15	14.7	10.9	Writers, journalists
	18	10.5	8.2	Sports professionals
	5	16.5	6.4	Biologists, agricultural and forestry specialists
	8	16.8	6.1	Statisticians, mathematicians, computer analysts, other like technicians
	17	26.8	5.5	Professional musicians, show business professionals
17				
	51	24.4	100	Owners or managers of hotel, restaurant services working in restaurants
FEMALE				
Agriculture				
18				
	62	51.2	100	Agricultural workers, ranchers, ranch hands working in livestock production
Blue Collar				
19				
	79	85.8	100	Garment workers
20				
	97	44.7	35.3	Cargo handlers working in manufacturing.
	77	44.9	32.2	Other food, drink preparation workers
	80	49,0	29.6	Other shoemakers
	91	40,0	2.9	Paper, cardboard factory workers
21				
	75	59,0	96.2	Textile workers
	78	67.2	3.8	Tobacco production workers
White Collar				
22				
	39	42.1	47	Employees in administrative services in non-classified areas working in other services
	39	34.8	38.2	Employees in administrative services in non-classified areas working in agriculture, mining, and industry
	39	39.1	10.5	Employees in administrative services in non-classified areas working in wholesale trade
	39	38.5	3	Employees in administrative services in non-classified areas working in hotels, restaurants, and other lodging services
	52	42.7	1.3	Supervisors of domestic service personnel

23				
	45	62.1	80.6	Sales assistants, sales representatives working in retail trade
	39	54.6	11.2	Employees in administrative services in non-classified areas working in retail trade
	45	51.2	8.2	Other sales assistants, sales representatives
24				
	55	64.4	24	Concierges, building supervisors, cleaning service personnel working in other services
	59	68.1	19.7	Personnel in other services not classified in other subgroups working in education, health, and other services
	57	72.1	17.6	Hair stylists, beauty treatment personnel
	55	67.2	13.1	Concierges, building supervisors, cleaning service personnel working in trade, transport, and finance
	56	76,0	7.2	Dry cleaning, laundry service employees
	53	59.9	6.6	Other chefs, cooks, food service personnel
	38	78.2	6.3	Telephone and telegraph operators
	55	58.7	5.4	Concierges, building supervisors, cleaning service personnel working in agriculture, mining, industry, and construction
25				
	55	89.2	61.7	Concierges, building supervisors, cleaning service personnel working in the household sector
	54	94.4	24.3	Domestic service personnel, other like personnel
	32	93,0	14	Stenographers, typists, key-punch operators
26				
	53	42,0	83.7	Chefs, cooks, food service personnel working in hotels, restaurants, and other lodging services
	59	33.8	9.4	Personnel in other services not classified in other subgroups working in trade
	59	36.9	6.9	Other personnel in other services not classified in other subgroups
27				
	7	74.5	75.7	Medical, veterinary, pharmaceutical assistants and technicians
	33	73.9	24.3	Employees in accounting, cashier, teller positions working in trade and miscellaneous repair services
Professional Managerial				

28				
	41	45.7	97.2	Owners or managers of commercial establishments working in retail trade
	51	52.9	2.8	Owners or managers of hotel, restaurant services working in hotels and other lodging services
29				
	13	58.6	94.6	Teachers
	19	58.7	5.4	Professionals or technicians in non-classified areas

NOTES

(1) For instance, the effect of aggregation on the gender segregation induced by occupational choice, or the relative importance of the gender segregation induced by either the occupational or the industrial choice -see, Sections 7.2 to 7.5 in Flückiger and Silber (1999).

(2) See, *inter alia*, Gross (1968), Blau (1977), Blau and Hendricks (1979), Williams (1979), England (1981), Beller (1985), Albelda (1986), Jacobs (1989), Jacobsen (1994), Blau *et al.* (1998). For a recent treatise on segregation, see Flückiger and Silber (1999).

(3) See James and Taeuber (1985), and Siltanen *et al.* (1993). For a recent survey, see Chapters 4 and 5 in Flückiger and Silber (1999).

(4) As an alternative to the entropy based decomposition, one could use the Gini-Segregation index. In this case, the overall segregation must be decomposed into three terms: a between-group term, a within-group term and a third interaction term -see Silber (1989) and Section 7.4 of Flückiger and Silber (1999).

(5) Among the employed, however, there are some interesting differences across age/education characteristics: among the older employed, the proportion of females decreases with the educational level, but among the younger employed we find the opposite pattern. Since the proportion of females among the employed is very low, the segregation indexes for the younger females with a secondary or a College education become relatively high: 7.4 and 8.4, respectively. Of course, since these two groups represent only about 10 per cent of the population, the segregation index induced by age/education characteristics in the employed cell as a whole is only 1.76.

(6) In empirical studies using Census data, the occupational space typically reaches several hundred categories. For instance, in the U.S. Blau *et al.* (1998) work with 470 occupations from the 1970, 1980, and 1990 Census.

(7) Albelda (1986) provides indirect evidence about the small role played by educational factors in accounting for changes in gender segregation in the U.S. from 1958 to 1981.

(8) For a detailed analysis of the contribution of specific occupational categories, as well as the role of the public sector in this process, see Mora and Ruiz-Castillo (2000).

(9) The slight decline in gender segregation in the employed population we observe for the Spanish economy in the 1977-1992 period, is broadly consistent with the relative stability shown by the dissimilarity index in the U.S. throughout the first half of the twentieth century (see Jacobs (1989), and the discussion of the early papers on the U.S. in England (1991)). This period in the U.S. is characterized by low female

labor participation rates comparable to the Spanish ones: in 1960, that rate was 37.7 per cent in the U.S. -see Beller (1981).

(10) The pattern of gender segregation in the U.S. changes substantially since the 1970s, when occupational segregation in the employed population began to decline noticeably (compare with footnote 10). Beller (1985) and Blau *et al.* (1997) offers some evidence in favor of the idea that in the U.S. laws on equal employment opportunity introduced since 1972 have contributed to this decrease. For instance, changes in the sex composition of occupations were the predominant cause of the decrease in segregation in both the 1970s and the 1980s, suggesting that expanding opportunities for women, particularly in nontraditional occupations at the white-collar level, played a significant role.

(11) Albelda (1986) obtained very interesting results in racial and gender segregation in the U.S. during the 1958-1981 period. However, he measured the two phenomena separately using the dissimilarity index which is not additively decomposable. Instead, Boisso *et al.* (1994) provide an appropriate measurement instrument, namely, a multidimensional version of the Gini segregation index.

(12) Recall that while weighted gender segregation indexes are bounded between 0 and 1, each unweighted direct segregation index is bounded only from below.

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Table 1. Descriptive Statistics and Direct Gender Segregation Indexes in the Partitions By Age, Education and Labor Market Participation In 1977

a = AGE	Female $100(F_a/F)$	Male $100(M_a/M)$	Total $100(T_a/T)$	$W_a = F_a/T_a$	I^a
1. 16 - 30	23.4	24.6	24.0	52.0	0.04
2. 31 - 50	34.4	37.4	35.8	51.1	0.13
3. More than 50	42.2	38.0	40.2	55.8	0.19
TOTAL 1% lower bound 99% upper bound	100.0	100.0	100.0	F/T = 53.2	$I^B_{(a)} = 0.13$ 0.08 0.19

e = EDUCATION	Female $100(F_e/F)$	Male $100(M_e/M)$	Total $100(T_e/T)$	$W_e = F_e/T_e$	I^e
Low education	31.2	22.4	27.1	61.3	1.92
Primary education	57.7	61.2	59.3	51.8	0.06
Secondary education	8.6	11.6	10.0	45.8	1.58
College education	2.5	4.8	3.6	36.9	7.76
TOTAL 1% lower bound 99% upper bound	100.0	100.0	100.0	F/T = 53.2	$I^B_{(e)} = 0.99$ 0.87 1.18

i = AGE/EDUCATION	Female $100(F_i/F)$	Male $100(M_i/M)$	Total $100(T_i/T)$	$W_i = F_i/T_i$	I^i
LOW EDUCATION	31.2	22.5	27.1		
1. 16 - 50	10.6	8.9	9.8	57.8	0.60
2. More than 50	20.6	13.6	17.3	63.3	3.00
PRIMARY EDUCATION	57.7	61.3	59.3		
3. 16 - 30	15.4	16.3	15.8	51.8	0.06
4. 31 - 50	22.4	24.2	23.2	51.4	0.10
5. More than 50	19.9	20.8	20.3	52.2	0.03
SECONDARY EDUCATION	8.6	11.6	9.9		
6. 16 - 30	5.2	5.7	5.4	51.4	0.10
7. 31 - 50	2.3	3.8	3.0	40.3	4.86
8. More than 50	1.1	2.1	1.5	37.2	7.52
COLLEGE EDUCATION	2.5	4.8	3.6		
9. 16 - 30	0.9	1.0	1.0	49.6	0.37
10. 31 - 50	1.0	2.2	1.5	33.9	10.87
11. More than 50	0.6	1.6	1.1	29.4	16.71
TOTAL 1% lower bound 99% upper bound	100.0	100.0	100.0	F/T = 53.2	$I^B_{(i)} = 1.23$ 1.10 1.42

Table 1. (continued)

k= LABOR MARKET STATUS	Female $100(F_k/F)$	Male $100(M_k/M)$	Total $100(T_k/T)$	$w_{ik} = F_k/T_k$	I^k
1. Employed	27.5	78.2	51.2	28.6	17.9
UNEMPLOYED	1.4	4.0	2.6		
2. Having worked before	0.8	0.9	0.8	51.3	0.1
3. Searching for the first job	0.6	3.1	1.8	19.1	35.6
INACTIVES	71.0	17.9	46.2		
4. Pensioners and disabled	8.2	15.0	11.4	38.4	6.4
5. Housework	62.8	2.9	34.8	96.1	68.0
TOTAL 1% lower bound 99% upper bound	100.0	100.0	100.0	F/T = 53.2	$I^B_{(k)}$ = 34.2 33.6 35.1

Note:

Bootstrapped lower (1 percent) and upper (99 percent) bounds were obtained from 1,000 empirical sample replications with replacement.

Table 2. Descriptive Statistics and Indexes Of Gender Segregation Induced By Age/education Characteristics Within Selected Labor Market Status Subgroups in 1977

k = 1, Employed

i = AGE/EDUCATION	Female $100(F_{ki}/F_k)$	Male $100(M_{ki}/M_k)$	Total $100(T_{ki}/T_k)$	$w_{ki} = F_{ki}/T_{ki}$	I_{ki}
LOW EDUCATION	17.4	16.5	16.8		
1. 16 - 50	8.8	9.3	9.2	27.4	0.05
2. More than 50	8.6	7.2	7.6	32.3	0.47
PRIMARY EDUCATION	60.4	64.9	63.5		
3. 16 - 30	25.6	18.9	20.8	35.1	1.45
4. 31- 50	22.0	29.5	27.3	23.0	1.14
5. More than 50	12.8	16.5	15.4	23.6	0.91
SECONDARY EDUCATION	16.6	13.2	14.2		
6. 16 - 30	12.6	6.5	8.3	43.6	7.37
7. 31 - 50	3.0	4.8	4.3	20.2	2.69
8. More than 50	1.0	1.9	1.6	17.5	4.79
COLLEGE EDUCATION	5.6	5.4	5.4		
9. 16 - 30, College	2.3	1.2	1.5	44.7	8.38
10. 31 -50, College	2.3	2.7	2.6	25.4	0.38
11. More than 50, College	1.0	1.5	1.3	21.2	2.05
TOTAL	100.0	100.0	100.0	$F_k/T_k = 28.6$	$I_k = 1.76$

k = 5, Housework

i = AGE/EDUCATION	Female $100(F_{ki}/F_k)$	Male $100(M_{ki}/M_k)$	Total $100(T_{ki}/T_k)$	$w_{ki} = F_{ki}/T_{ki}$	I_{ki}
LOW EDUCATION	33.4	53.9	34.2		
1. 16 - 50	12.8	23.0	13.2	93.2	1.33
2. More than 50	20.6	30.9	21.0	94.3	0.58
PRIMARY EDUCATION	60.1	41.1	59.4		
3. 16 - 30	12.3	6.3	12.1	98.0	0.78
4. 31- 50	25.8	10.6	25.2	98.4	1.24
5. More than 50	22.0	24.2	22.1	95.7	0.03
SECONDARY EDUCATION	5.4	3.4	5.3		
6. 16 - 30	2.0	1.9	2.0	96.4	0.02
7. 31 - 50	2.3	0.8	2.2	98.6	1.53
8. More than 50	1.1	0.7	1.1	97.6	0.48
COLLEGE EDUCATION	1.1	1.5	1.1		
9. 16 - 30, College	0.3	0.3	0.3	95.5	0.08
10. 31 -50, College	0.5	0.5	0.5	96.6	0.04
11. More than 50, College	0.3	0.7	0.3	91.0	3.74
TOTAL	100.0	100.0	100.0	$F_k/T_k = 96.1$	$I_k = 0.76$

Table 3. Gender Segregation in the Employed Population Induced By Occupational Choices and Age/education Characteristics. Summary Information for 12 Aggregate Occupational Categories, 1977 and 1992

	1977				1992			
OCCUPATION	I^c	I_c	I(c)	α_c	I^c	I_c	I(c)	α_c
MALE	13.5	0.7	14.2	0.94	13.2	0.7	13.9	0.99
1. Agriculture	1.0	0.1	1.1	0.33	0.5	0.1	0.6	0.33
2. Blue Collar	9.4	0.4	9.8	1.18	10.4	0.3	10.7	1.31
3. White Collar	1.3	0.2	1.5	0.86	1.0	0.2	1.2	0.54
4. Prof. And Manag.	1.4	0.1	1.4	0.96	0.9	0.1	1.1	0.62
5. Armed Forces:	0.4	0.0	0.4	1.59	0.4	0.0	0.4	1.97
INTEGRATED	0.3	0.8	1.1	0.21	0.2	0.2	0.4	0.12
6. Agriculture:	0.2	0.3	0.5	0.18	0.0	0.0	0.0	0.04
7. Blue Collar	0.1	0.4	0.5	0.27	0.2	0.0	0.2	0.17
8. Prof. And Manag.	0.0	0.1	0.1	0.21	0.0	0.1	0.1	0.12
FEMALE	13.4	1.9	15.3	1.44	13.3	1.2	14.5	1.25
9. Agriculture:	0.3	0.1	0.4	0.83	0.2	0.1	0.2	0.72
10. Blue Collar	3.0	0.2	3.3	1.74	1.3	0.1	1.4	1.23
11. White Collar	9.2	1.4	10.6	1.59	10.5	0.8	11.3	1.44
12. Prof. And Manag	0.9	0.2	1.1	0.67	1.3	0.2	1.5	0.67
TOTAL 1% lower bound 99% upperbound	$\hat{I}^B_{(j)} = 27.2$ 26.4 28.2	$\hat{I}^W_{(j)} = 3.4$ 3.3 4.1	$\hat{I} = 30.6$ 30.1 31.8	-	$\hat{I}^B_{(j)} = 26.7$ 25.9 27.7	$\hat{I}^W_{(j)} = 2.1$ 2.1 2.8	$\hat{I} = 28.8$ 28.3 30.3	-

Note:

$I^c = \Sigma_{j \in C} (T_j/T) \hat{I}^j$ = Direct gender segregation induced by occupational choices in aggregate category c = 1,..., 12

$I_c = \Sigma_{j \in C} (T_j/T) \hat{I}_j$ = Gender segregation induced by age/education characteristics within the occupations in aggregate category c = 1,..., 12

$I(c) = I^c + I_c$ = Gender segregation in the employed population in aggregate category c = 1,..., 12

$\alpha_c = \Sigma_{j \in C} (T_j/T) \alpha_j \geq 1 \Leftrightarrow$ Category c contributes to overall segregation above (below) its demographic importance

$\hat{I}^B_{(j)} = \Sigma_c I^c = \Sigma_j (T_j/T) \hat{I}^j$ = Direct gender segregation induced by occupational choices in the employed population

$\hat{I}^W_{(j)} = \Sigma_c I_c = \Sigma_j (T_j/T) \hat{I}_j$ = Gender segregation induced by age/education characteristics within the occupations in the employed population

Bootstrapped lower (1 percent) and upper (99 percent) bounds were obtained from 1,000 empirical sample replications with replacement.

Table 4. Decomposition of Overall Gender Segregation in the Partition By Labor Market Status in 1977

k = LABOR MARKET STATUS	I^k	+ $\hat{I}^B_{(j)}$	+ I_k	= I(k)	$I(k) / I^*$
1. Employed	17.9	27.3	3.4	48.6	0.96
UNEMPLOYED					
2. Having worked before	0.1	-	1.7	1.8	0.04
3. Searching for the first job	35.6	-	6.6	42.3	0.84
INACTIVES					
4. Pensioners and disabled	6.4	-	2.8	9.2	0.18
5. Housework	68.0	-	0.8	68.8	1.36
TOTAL	$I^B_{(k)} = 34.2$	$(T_1/T)\hat{I}^B_{(j)} = 14.0$	2.5	$I^* = 50.6$	-
1% lower bound	33.6	13.5	2.4	50.2	
99% upper bound	34.9	14.5	2.8	51.5	

Note:

I^k = index of direct gender segregation in labor market subgroup k

$\hat{I}^B_{(j)}$ = index of direct gender segregation induced by occupational choices in the employed population

I_k = index of gender segregation induced by age/education characteristics within labor market subgroup if k ≠1; index of gender segregation induced by age/education characteristics within occupations in the employed population if k = 1

I(k) = index of overall gender segregation in labor market subgroup k

Bootstrapped lower (1 percent) and upper (99 percent) bounds were obtained from 1,000 empirical sample replications with replacement.

Table 5. Descriptive Statistics in the Partitions By Age/education and Labor Market Status in 1992

i = AGE/EDUCATION	Female $100(F_i/F)$	Male $100(M_i/M)$	Total $100(T_i/T)$	$W_i = F_i/T_i$	I^i
LOW EDUCATION	**27.2**	**19.4**	**23.4**		
1. 16 - 50	5.2	4.4	4.8	56.1	0.51
2. More than 50	22.0	15.0	18.6	61.2	2.54
PRIMARY EDUCATION	**41.1**	**41.4**	**41.2**		
3. 16 - 30	3.6	5.1	4.3	43.1	2.23
4. 31 - 50	16.7	16.3	16.5	52.4	0.01
5. More than 50	20.8	20.0	20.4	52.9	0.03
SECONDARY EDUCATION	**25.0**	**31.5**	**28.1**		
6. 16 - 30	13.4	16.2	14.8	47.1	0.65
7. 31 - 50	9.1	11.5	10.2	46.0	0.98
8. More than 50	2.5	3.8	3.1	41.6	3.08
COLLEGE EDUCATION	**6.8**	**7.8**	**7.2**		
9. 16 - 30	2.2	1.5	1.8	61.1	2.51
10. 31 - 50	3.3	4.1	3.7	46.4	0.86
11. More than 50	1.3	2.2	1.7	38.6	5.10
TOTAL 1% lower bound 99% upper bound	**100.0**	**100.0**	**100.0**	**F/T = 51.9**	$I^B_{(0)}$ **= 1.06** **0.92** **1.21**

Table 5. (continued)

k = LABOR MARKET STATUS	Female $100(F_k/F)$	Male $100(M_k/M)$	Total $100(T_k/T)$	$w_{ik} = F_k/T_k$	I^k
1. Employed	27.8	62.0	44.3	32.6	10.93
UNEMPLOYED	8.3	9.2	8.7	0.0	0.00
2. Having worked before	2.1	1.1	1.6	67.9	7.59
3. Searching for the first job	6.2	8.1	7.1	45.4	1.21
INACTIVES	63.8	28.8	47.0	0.0	0.00
4. Pensioners and disabled	8.9	22.6	15.5	29.8	14.39
5. Housework	54.9	6.2	31.5	90.5	50.55
TOTAL	**100.0**	**100.0**	**100.0**	**F/T = 51.9**	**$I^B_{(k)}$ = 23.2**
1% lower bound					**22.6**
99% upper bound					**23.8**

Note:

Bootstrapped lower (1 percent) and upper (99 percent) bounds were obtained from 1,000 empirical sample replications with replacement.

Table 6. Decomposition of Overall Gender Segregation in the Partition By Labor Market Status in 1992

k = LABOR MARKET STATUS	I^k	+ $\hat{I}^B_{(j)}$	+ I_k	= I(k)	$I(k)/I^*$
1. Employed	10.9	26.7	2.1	39.8	1.08
UNEMPLOYED					
2. Having worked before	7.6	-	6.0	13.6	0.37
3. Searching for the first job	1.2	-	3.1	4.4	0.12
INACTIVES					
4. Pensioners and disabled	14.4	-	1.1	15.5	0.42
5. Housework	50.6	-	1.3	51.8	1.41
TOTAL	$I^B_{(k)} = 23.2$	$(T_1/T)\hat{I}^B_{(j)} = 11.8$	1.9	$I^* = 36.9$	-
1% lower bound	22.6	11.4	1.8	36.4	
99% upper bound	23.8	12.3	2.2	37.7	

Note:

I^k = index of direct gender segregation in labor market subgroup k

$\hat{I}^B_{(j)}$ = index of direct gender segregation induced by occupational choices in the employed population

I_k = index of gender segregation induced by age/education characteristics within labor market subgroup if $k \neq 1$; index of gender segregation induced by age/education characteristics within occupations in the employed population if $k = 1$

$I(k)$ = index of overall gender segregation in labor market subgroup k

Bootstrapped lower (1 percent) and upper (99 percent) bounds were obtained from 1,000 empirical sample replications with replacement.

Table 7. Changes in Overall Gender Segregation During the 1977-1993 Period Within the Labor Market Participation Partition. Dynamic Decomposition in Percentage Terms

$$S^k_k + S^j_k + S^i_k = S_k \qquad D_k \qquad \Delta I(k) = S_k + D_k$$

1. Employed	-3.6	-1.2	-0.4	-5.2	-2.1	-7.3
UNEMPLOYED						
2. Having worked before	0.1	0.0	0.0	0.1	0.1	0.2
3. Searching for the first job	-0.6	0.0	-0.1	-0.7	0.2	-0.4
INACTIVES						
4. Pensioners and disabled	0.9	0.0	-0.2	0.7	0.6	1.3
5. Housework	-6.1	0.0	0.3	-5.7	-1.9	-7.6
TOTAL	**-9.3**	**-1.2**	**-0.3**	**-10.8**	**-3.0**	**-13.7**
1% lower bound	**-10.1**	**-1.8**	**-0.5**	**-11.6**	**-3.8**	**-14.7**
99% upper bound	**-8.5**	**-0.6**	**0.5**	**-9.6**	**-2.7**	**-12.9**

Note:

S^k_k = Change in the gender segregation induced by labor market participation decisions

S^j_k = Change in the gender segregation induced by occupation decisions

S^i_k = Change in the gender segregation induced by age/education characteristics

$S_k = S^k_k + S^j_k + S^i_k$

D_k = Change in the gender segregation induced by changes in demographic weights

$\Delta I(k) = S_k + D_k$ = Change in overall gender segregation

Bootstrapped lower (1 percent) and upper (99 percent) bounds were obtained from 1,000 empirical sample replications with replacement.

Figure 1. A. Evolution of the Female Percentages Among the Employed and Those Devoted to Housework

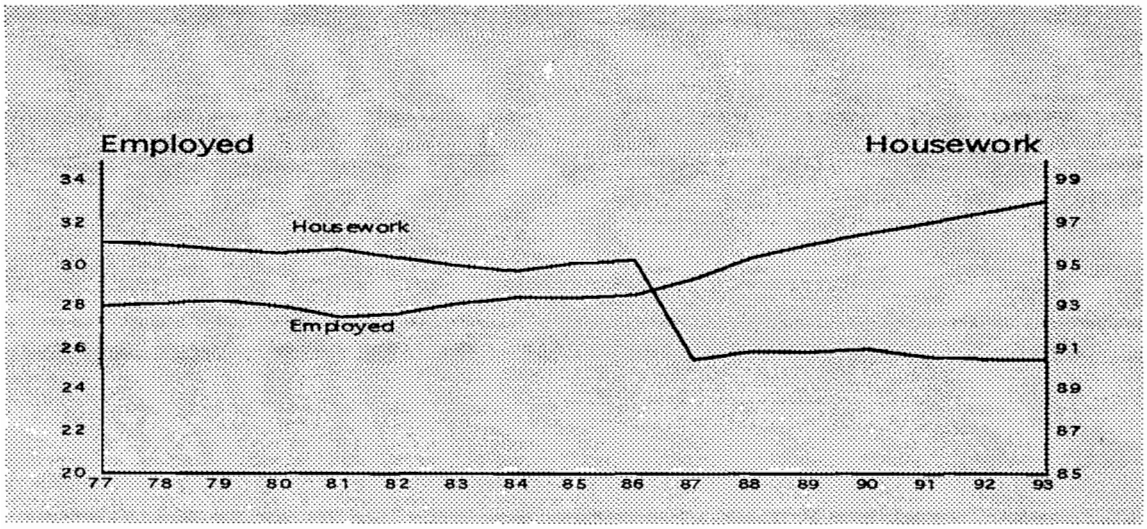

Figure 1. B. Evolution of the Segregation induced by Labor Market Status and Occupational Choices

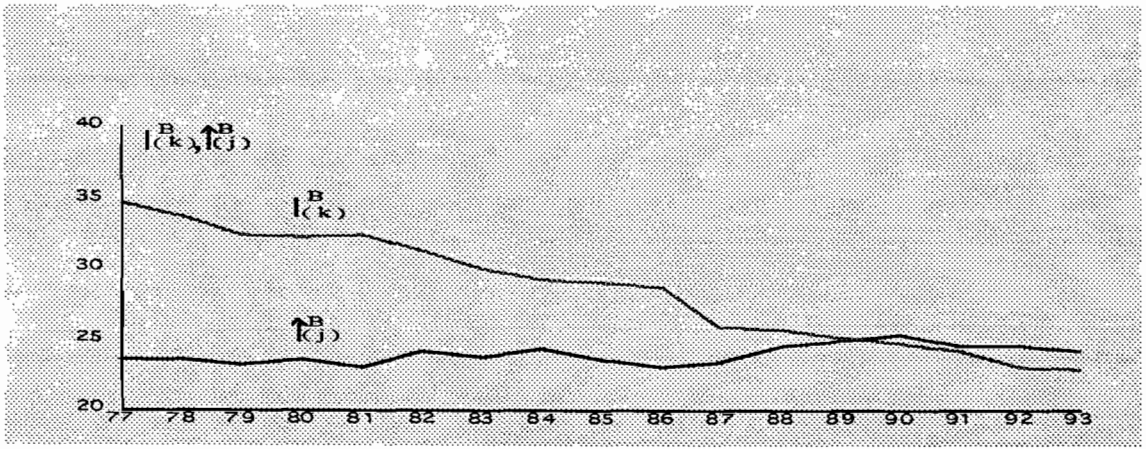

Table 8A. Decomposition of Overall Gender Segregation in the Partition by Age/education Characteristics In 1977

i = AGE/EDUCATION	I^i + Direct Segr.	I_i + Due to Lab. Mk. Part.	I'_i = Due to Occups.	I^*_i Overall Segregation	I_i^*/I^*
LOW EDUCATION					
1. 16 - 50,	0.6	37.7	15.2	53.5	1.06
2. More than 50	3.0	26.3	6.2	35.4	0.70
PRIMARY EDUCATION					
3. 16 - 30	0.1	27.6	24.5	52.2	1.03
4. 31- 50	0.1	47.3	17.3	64.7	1.28
5. More than 50	0.0	39.6	9.0	48.6	0.96
SECONDARY EDUCATION					
6. 16 - 30	0.1	11.1	22.2	33.4	0.66
7. 31 - 50	4.9	40.7	17.6	63.1	1.25
8. More than 50	7.5	41.6	8.8	57.9	1.14
COLLEGE EDUCATION					
9. 16 - 30	0.4	7.8	18.7	26.9	0.53
10. 31 -50	10.9	17.9	20.9	49.6	0.98
11. More than 50	16.7	14.3	13.5	44.5	0.88
TOTAL 1% lower bound 99% upper bound	$I^B_{(i)} = 1.2$ 1.1 1.4	$I^W_{(i)} = 34.6$ 34.0 35.3	$\hat{I}^W_{(i)} = 14.8$ 14.4 15.4	$I^* = 50.6$ 50.2 51.4	-

Note:

Bootstrapped lower (1 percent) and upper (99 percent) bounds were obtained from 1,000 empirical sample replications with replacement.

Table 8B. Decomposition of Overall Gender Segregation in the Partition by Age/education Characteristics In 1992

i = AGE/EDUCATION	I^i +	I_i +	I'_i =	I^*_i	I_i^*/I^*
LOW EDUCATION					
1. 16 - 50,	0.5	18.9	13.9	33.3	0.90
2. More than 50	2.5	26.8	3.6	32.9	0.89
PRIMARY EDUCATION					
3. 16 - 30	2.2	14.6	18.6	35.4	0.96
4. 31- 50	0.0	31.8	17.1	48.9	1.33
5. More than 50	0.0	35.2	6.0	41.3	1.12
SECONDARY EDUCATION					
6. 16 - 30	0.6	7.4	19.1	27.1	0.74
7. 31 - 50	1.0	22.3	17.6	40.8	1.11
8. More than 50	3.1	32.0	6.5	41.6	1.13
COLLEGE EDUCATION					
9. 16 - 30	2.5	0.4	11.5	14.4	0.39
10. 31 -50	0.9	5.2	16.9	22.9	0.62
11. More than 50	5.1	12.9	11.9	29.9	0.81
TOTAL 1% lower bound 99% upper bound	$I^B_{(i)} = 1.1$ 0.9 1.2	$I^W_{(i)} = 23.8$ 23.2 24.3	$\hat{I}^W_{(i)} = 12.0$ 11.8 12.7	$I^* = 36.9$ 36.4 37.7	-

Note:

Bootstrapped lower (1 percent) and upper (99 percent) bounds were obtained from 1,000 empirical sample replications with replacement.

Table 9. Changes in Overall Gender Segregation During the 1977-1992 Period. Dynamic Decomposition In Percentage Terms

	S^k_i +	S^l_i +	S^i_i =	S_i	D_i	$\Delta I(i) = S_i + D_i$
LOW EDUCATION						
1. 16 - 50	-1.8	-0.1	-0.0	-1.9	-1.7	-3.6
2. More than 50	-0.1	-0.2	-0.1	-0.3	0.3	-0.0
PRIMARY EDUCATION						
3. 16 - 30	-1.7	-0.3	0.3	-1.6	-5.1	-6.7
4. 31 - 50	-3.0	-0.3	-0.0	-3.3	-3.7	-7.0
5. More than 50	-1.1	-0.1	0.0	-1.2	-0.3	-1.4
SECONDARY EDUCATION						
6. 16 - 30	-0.2	-0.0	0.0	-0.2	2.4	2.2
7. 31 - 50	-0.5	-0.0	-0.1	-0.6	2.9	2.3
8. More than 50	-0.2	0.0	-0.1	-0.3	0.7	0.4
COLLEGE EDUCATION						
9. 16 - 30	-0.1	-0.1	0.0	-0.1	0.1	0.0
10. 31 - 50	-0.1	-0.1	-0.1	-0.3	0.4	0.1
11. More than 50	-0.0	0.0	-0.1	-0.1	0.2	0.0
TOTAL	**-8.7**	**-1.1**	**-0.2**	**-10.0**	**-3.8**	**-13.7**
1% lower bound	**-9.7**	**-1.8**	**-0.4**	**-11.0**	**-4.6**	**-14.7**
99% upper bound	**-7.7**	**-0.2**	**0.1**	**-8.8**	**-3.2**	**-12.9**

Note:

S^k_i = Change in the gender segregation induced by labor market participation decisions

S^l_i = Change in the gender segregation induced by occupation decisions

S^i_i = Change in the gender segregation induced by age/education characteristics

$S_i = S^k_i + S^l_i + S^i_i$

D_i = Change in the gender segregation induced by changes in demographic weights

$\Delta I(i) = S_i + D_i$ = Change in overall gender segregation

Bootstrapped lower (1 percent) and upper (99 percent) bounds were obtained from 1,000 empirical sample replications with replacement.

Table 10. Descriptive Statistics and Gender Segregation Indexes by Age/education Within Selected Age/education Subgroups in 1977 And 1992

1977: i = 4, Primary Education, 31 – 50 years of age (23.2 per cent of the population)

k = LABOR MARKET STATUS	Female $100(F_{ik}/F_i)$	Male $100(M_{ik}/M_i)$	Total $100(T_{ik}/T_i)$	$w_{ik} = F_{ik}/T_{ik}$	I_{ik}
1. Employed	27.0	95.3	60.2	23.0	24.3
UNEMPLOYED	**0.3**	**2.3**	**1.3**		
2. Having worked before	0.1	0.1	0.1	58.1	1.3
3. Searching for the first job	0.2	2.2	1.2	10.3	55.4
INACTIVES	**72.6**	**2.4**	**38.5**		
4. Pensioners and disabled	0.3	1.1	0.7	23.7	23.1
5. Housework	72.3	1.3	37.8	98.4	84.2
TOTAL	**100.0**	**100.0**	**100.0**	$F_i/T_i = 51.4$	$I_i = 47.3$

1992: i = 4, Primary Education, 31 – 50 years of age (16.5 per cent of the population)

k = LABOR MARKET STATUS	Female $100(F_{ik}/F_i)$	Male $100(M_{ik}/M_i)$	Total $100(T_{ik}/T_i)$	$w_{ik} = F_{ik}/T_{ik}$	I_{ik}
1. Employed	29.4	84.8	55.8	27.7	18.2
UNEMPLOYED	**9.6**	**9.5**	**9.5**		
2. Having worked before	1.5	0.1	0.8	93.6	59.8
3. Searching for the first job	8.1	9.4	8.7	48.7	0.4
INACTIVES	**61.0**	**5.7**	**34.7**		
4. Pensioners and disabled	0.3	1.5	0.9	19.9	32.5
5. Housework	60.7	4.2	33.8	94.1	61.4
TOTAL	**100.0**	**100.0**	**100.0**	$F_i/T_i = 52.4$	$I_i = 31.8$

Table A. Descriptive Statistics for the Employed Population In the Partition By Occupations and Age/education Characteristics, 1977

OCCUPATION	Female	Male	Total	W_i	I^j	I_i	I(j)	α_i = I(j)/I
MALE	10.5	64.7	49.0					
Agriculture	5.5	12.7	10.6					
1.	5.5	11.3	9.6	16.3	5.9	0.8	6.8	0.22
2.	0.0	1.4	1.0	0.7	43.4	0.5	44.0	1.43
Blue Collar	2.7	37.2	27.2					
3.	1.4	27.5	20.0	2.1	36.8	1.2	38.0	1.24
4.	0.3	6.4	4.6	1.8	37.8	0.7	38.4	1.25
5.	1.0	3.3	2.6	11.3	12.7	4.5	17.1	0.56
White Collar	1.5	7.1	5.5					
6.	0.3	3.1	2.3	3.3	32.0	1.9	33.8	1.10
7.	1.1	2.2	1.9	16.4	5.9	4.4	10.2	0.33
8.	0.1	1.8	1.3	2.5	35.1	1.9	37.0	1.21
Prof. And Manag.	0.8	6.6	4.9					
9.	0.6	4.4	3.3	4.8	27.2	0.6	27.9	0.91
10.	0.2	2.2	1.6	3.8	30.4	2.1	32.5	1.06
Armed Forces: 11	0.0	1.1	0.8	0.0	48.6	0.0	48.6	1.59
INTEGRATED	17.5	15.4	16.1					
Agriculture: 12	10.8	7.4	8.4	36.8	2.3	3.2	5.5	0.18
Blue Collar	5.2	5.9	5.8					
13.	2.4	3.5	3.2	21.4	2.0	8.4	10.4	0.34
14.	1.7	1.4	1.5	32.0	0.4	4.1	4.5	0.15
15.	1.1	1.0	1.1	29.0	0.0	6.3	6.3	0.21
Prof. And Manag.	1.5	2.1	1.9					
16.	0.7	1.1	1.0	19.6	3.1	4.2	7.3	0.24
17.	0.8	1.0	0.9	24.4	0.6	5.0	5.6	0.18
FEMALE	72.2	19.9	34.7					
Agriculture: 18	3.1	1.2	1.7	51.6	16.7	8.7	25.5	0.83
Blue Collar	13.9	3.1	6.1		3.0	0.2	3.3	0.11
19.	7.0	0.5	2.3	85.8	102.7	3.7	106.4	3.47
20.	3.5	1.7	2.2	45.9	9.6	3.1	12.7	0.41
21.	3.4	0.9	1.6	59.3	29.3	4.2	33.6	1.09
White Collar	45.6	12.0	21.6					
22.	7.6	4.8	5.6	38.8	3.5	10.5	14.0	0.46
23.	10.5	2.7	5.0	60.5	31.7	1.6	33.2	1.08
24.	9.6	1.8	4.0	67.8	47.5	5.9	53.4	1.74
25.	12.3	0.5	3.9	91.0	124.9	5.8	130.8	4.26
26.	3.4	1.9	2.3	41.1	5.1	7.1	12.2	0.40
27.	2.2	0.3	0.8	74.4	64.8	8.8	73.6	2.40
Prof. And Manag.	9.6	3.6	5.3					
28.	5.2	2.4	3.2	45.9	9.6	5.4	15.0	0.49
29.	4.4	1.2	2.1	58.5	27.9	1.3	29.3	0.95
TOTAL	100.0	100.0	100.0	W=28.6	$\hat{I}^B_{(j)}$ = 27.2	$\hat{I}^W_{(j)}$ = 3.4	I=30.6	-

$I^B_{(j)} = (T_j/T)\ I^j$ = Direct gender segregation induced by occupational choices
$I^{Wi}_{(j)} = (T_j/T)\ I_j$ = Gendresegregation induced by age/education characteristics within occupations
$I = I^B_{(j)} + I^{Wi}_{(j)}$ = Gendersegregation in the employed population

Table B. Descriptive Statistics for the Employed Population In the Partition By Occupations and Ag Characteristics, 1992

OCCUPATION	Female	Male	Total	W_j	I^j	I_j	I(j)	$\alpha_j = I(j)/I$
MALE	14.1	65.3	48.7					
Agriculture	3.8	7.0	5.9					
1.	3.8	6.1	5.3	23.2	3.1	1.5	4.5	0.16
2.	0.0	0.9	0.6	0.8	51.2	0.9	52.1	1.81
Blue Collar	3.9	39.8	28.2					
3.	1.8	28.5	19.8	2.9	40.9	0.8	41.6	1.44
4.	0.5	6.8	4.8	3.3	39.6	0.5	40.1	1.39
5.	1.6	4.5	3.6	14.8	12.0	2.8	14.8	0.51
White Collar	4.0	9.7	7.9					
6.	1.0	4.8	3.6	9.2	22.2	1.4	23.6	0.82
7.	2.2	2.7	2.6	27.5	0.9	5.8	6.7	0.23
8.	0.8	2.2	1.7	15.2	11.4	1.1	12.5	0.43
Prof. And Manag.	2.4	7.8	6.0					
9.	1.2	4.8	3.6	10.8	18.9	1.3	20.1	0.70
10.	1.2	3.0	2.4	16.1	10.0	4.3	14.3	0.50
Armed Forces: 11	0.0	1.0	0.7	0.0	56.9	0.0	56.9	1.97
INTEGRATED	9.3	11.7	11.0					
Agriculture: 12	3.1	3.1	3.1	32.7	0.0	1.1	1.1	0.04
Blue Collar	3.3	5.3	4.8					
13.	1.6	3.0	2.6	20.8	4.9	0.3	5.3	0.18
14.	1.3	1.4	1.4	30.4	0.2	1.0	1.1	0.04
15.	0.4	0.9	0.8	19.1	6.6	3.4	10.0	0.35
Prof. And Manag.	2.9	3.3	3.1					
16.	1.9	1.8	1.8	33.9	0.1	3.8	3.8	0.13
17.	1.0	1.5	1.3	25.3	1.8	1.5	3.3	0.11
FEMALE	76.6	23.0	40.4					
Agriculture: 18	1.6	0.6	1.0	55.2	15.5	5.2	20.7	0.72
Blue Collar	7.2	2.5	4.0					
19.	3.8	0.4	1.5	83.9	81.1	3.7	84.8	2.94
20.	2.5	1.6	1.9	42.3	2.9	1.1	4.0	0.14
21.	0.9	0.5	0.6	46.4	5.9	5.2	11.1	0.39
White Collar	54.2	14.6	27.4					
22.	13.2	5.4	7.9	54.3	14.3	4.1	18.4	0.64
23.	9.5	3.8	5.6	54.9	15.2	1.0	16.2	0.56
24.	11.6	1.9	5.1	74.5	53.2	1.4	54.5	1.89
25.	10.4	0.5	3.7	90.7	107.2	4.4	111.6	3.87
26.	3.4	2.4	2.7	40.9	2.2	4.1	6.3	0.22
27.	6.1	0.6	2.4	82.3	75.7	3.6	79.3	2.75
Prof. And Manag.	13.6	5.3	8.0					
28.	5.6	2.7	3.6	50.2	9.5	1.7	11.3	0.39
29.	8.0	2.6	4.4	59.4	21.7	4.1	25.8	0.90
TOTAL	100.0	100.0	100.0	W=32.6	$\hat{I}^B_{(j)}$=26.7	$\hat{I}^W_{(j)}$=2.1	I=28.8	-

$I^B_{(j)} = (T_j/T)\ I^j$ = Direct gendersegregation inducedby occupational choices
$I^{Wi}_{(j)} = (T_j/T)\ I_j$ = Gendresegregation inducedby age/education characteristics within occupations
$I = I^B_{(j)} + I^{Wi}_{(j)}$ = Gendersegregation in the employed population